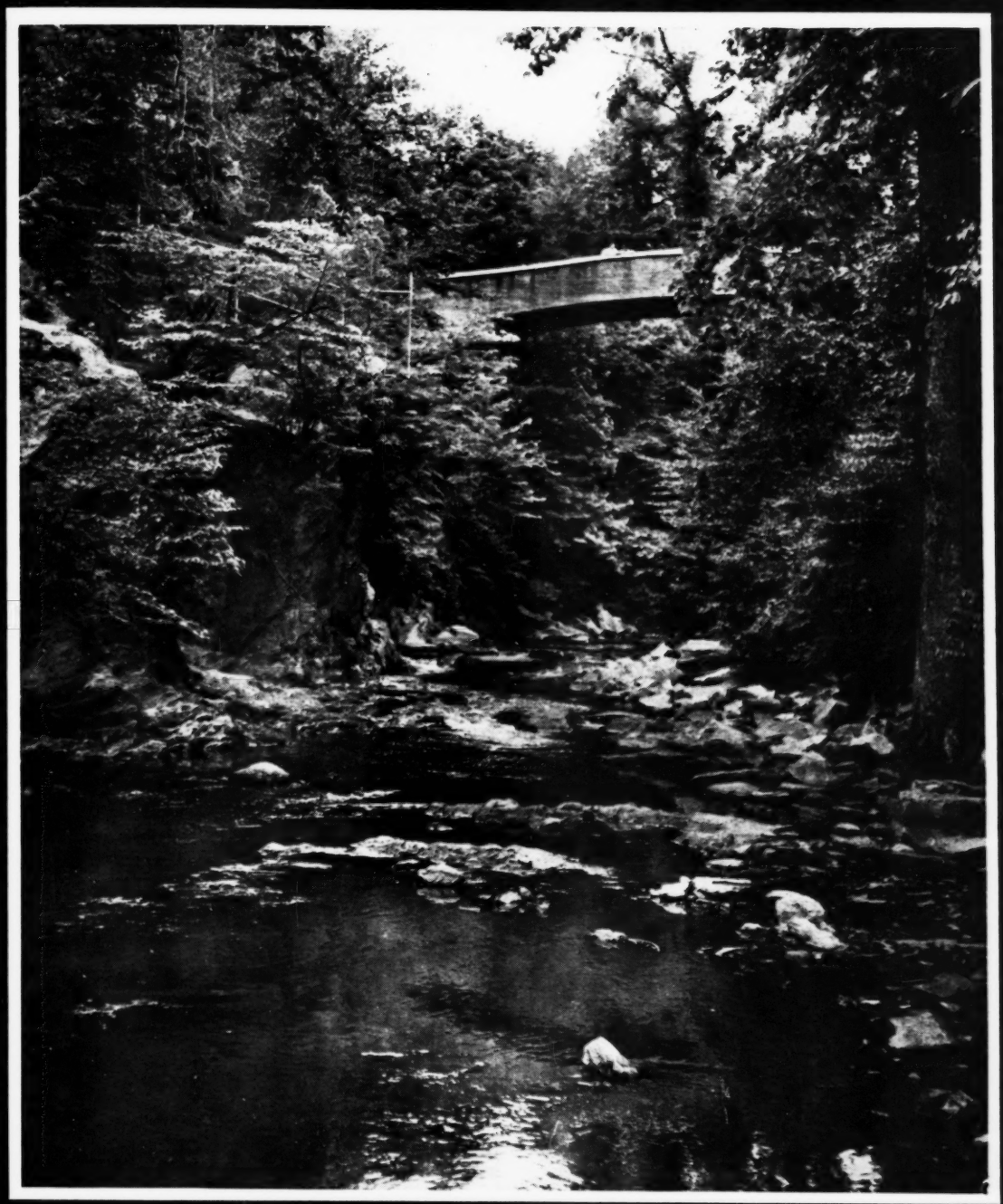

THE GARDEN JOURNAL

THE NEW YORK BOTANICAL GARDEN

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DOROTHY EBEL HANSELL
Editor

CALENDAR

September 18-23, 1960. Fortieth Annual National Conference on State Parks, Samoset Hotel, Rockland, Maine.

September 19-21, 1960. National Council of State Garden Clubs, Central Atlantic Regional Meeting, Statler Hilton Hotel, Buffalo, New York.

September 21-22, 1960. Annual Show of American Dahlia Society and Dahlia Society of New Jersey, Garden State Plaza, Paramus, New Jersey.

September 24, 1960. Sixth Annual Flower Show of North Jersey Rose Society, Colonial Life Insurance Building, East Orange, New Jersey.

October 7-9, 1960. Second Mid-American Orchid Congress and Show, with Illinois Orchid Society as host. Congress at Sherman Hotel, Chicago; Show at Chicago Federal Savings and Loan Association.

October 15-23, 1960. Flower Show of Ninth District, Federated Garden Clubs of New York State, Inc., in conjunction with Home and Garden Show, County Center, White Plains, New York.

October 18, 1960. Open Garden Day at The New York Botanical Garden.

November 4, 1960, 1 p.m. Chrysanthemum Show in Conservatory of The New York Botanical Garden opens to members of the Garden.

November 5, 1960, 10 a.m. Chrysanthemum Show in Conservatory opens to the public.

November 10-12, 1960. Fifteenth American Horticultural Congress with headquarters at Huntington Sheraton Hotel, Pasadena, California.

November 15, 1960. Open Garden Day at The New York Botanical Garden.

December 8, 1960. Annual Holiday House Tour sponsored by the Volunteer Associates of The New York Botanical Garden.

January 5, 12, 19, 26, 1961, 11 a.m. Downtown Lecture Series sponsored by the Volunteer Associates of The New York Botanical Garden. Mrs. John Fiske and Mrs. Marcus Fair, Co-Chairmen of the Committee on Arrangement.

January 9, 1961. Theatre Benefit sponsored by the Volunteer Associates of The New York Botanical Garden; "Critic's Choice," with Henry Fonda, at the Barrymore Theatre. Mrs. Marshall F. Dancy and Mrs. Oliver A. Vietor, Co-Chairmen of the Committee on Arrangements.

March 4-12, 1961. International Flower Show, The Coliseum, New York, N. Y.

April 28-May 7, 1961. International Flower Show in Valentino Park, Torino, Italy. For information: Dr. Guido Nani, Secretary, Piedmont Horticultural Society, Lungo Dora Firenze, 119, Torino, Italy.

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CREDIT FOR ILLUSTRATIONS

We are indebted to the Display Committee, Mrs. Charles Burlingham, Mrs. Richard S. Meredith, and Mrs. Donald B. Straus, for the selection of the front cover illustration—the footbridge over the Bronx River in The New York Botanical Garden, photo by E. N. Mitchell; pp. 167-170, Brookhaven National Laboratory, Upton, L. I.; pp. 173-177, Andre Viette; pp. 178-180, The Davey Tree Expert Co., Kent, O.; pp. 182-185, TVA Division of Forestry Relations, Clinton, Tenn.; p. 200, E. N. Mitchell; p. 201, Gottscho-Schleisner; p. 202, Dr. Richard M. Klein; p. 186, **Chelone glabra**; p. 187, **Erythronium americanum**; p. 188, **Pyrola elliptica**; p. 189, **Scilla hispanica (S. campanulata)**, crocus, **Galanthus nivalis**, **Scilla sibirica**, tulip, and **Narcissus poeticus**; p. 192, hepatica by Charles C. Clare, Jr.; special insert, T. H. Everett.

The Garden Journal is published bimonthly by The New York Botanical Garden, Bronx Park, New York 58, N. Y. at 400 Watchung Ave., Plainfield, N. J. Second Class Postage paid at Plainfield, N. J. Annual subscription, $3.00. Single copies $.55. Foreign countries and anywhere outside the continental United States, $.50 a year extra.

MOLECULES IN THE LIFE OF A PLANT

By George L. McNew

Dr. McNew is Managing Director of the Boyce Thompson Institute for Plant Research, Inc., Yonkers, New York. He delivered the following talk at the graduation exercises for the Two-year Courses in Practical Gardening and Botany at The New York Botanical Garden on June 21, 1960.

THE SCIENCE of botany and the arts of horticulture are undergoing revolutionary changes which were undreamed of three decades ago. The old concepts about the relationship of species and cultivars as morphological units have served as the foundation of a new science. Man has come to consider plants as so much plastic material which can be molded and shaped to suit his purposes.

The behavior of plants as living things has become increasingly important as he has sought to increase their efficiency and usefulness. It is well known that they do not have a central nervous system. However, the parts are so coordinated that the entire organism functions most beautifully as an integrated unit. Because of this, man has long been prone to ascribe purpose to the behavior of plants, as though action arose from mental design.

However, the answer to plant behavior must be sought elsewhere. Why do plants follow such rigid rules of conduct that one can predict their response to changes in environment, competition with other species, and reaction to a multitude of commensal and antagonistic microorganisms? What are the latent possibilities of every living cell in the plant regardless of whether it is especially differentiated for lateral or terminal growth, reproduction, synthesis of food, nutrient and water procurement, or protection and re-enforcement of delicate tissues?

The answers to these questions lead one to the study of chemicals in the living cell. The coordination of cell functions and differentiation into tissues for special uses trace down to the behavior of the chemical compounds in the cells. There are thousands upon thousands of these compounds operating in a world of free enterprise and governed by basic laws. It is the duty of the trained botanist and horticulturist to ferret out and understand these basic laws or principles because through them, and them alone, will man make full use of plants in satisfying his material and esthetic needs.

In the life of any plant there are thousands of molecules. Some of these molecules serve in growth and reproduction, others in disease-induction and resistance to pests, still others regulate the hereditary processes. To this native complement of complex organic systems must be added the foreign molecules that have been conceived and designed by man to enter into the living cell in order to destroy or to retard the normal functions, or subvert them into channels he considers desirable.

Without pretense of being systematic or exhaustive, I should like to discuss some of the recent developments in plant chemistry. A few examples may serve to illustrate how our concepts are growing and the potential usefulness of these concepts. Perhaps the graduates whom we have come here to honor will find in these activities of plants another dimension for their respect and appreciation of plant life.

The Dynamic Processes of the Cell in Photosynthesis

The greatest factory on the face of the earth is located in the foliage of plants. In terms of energy transfer or chemical synthesis, the process of photosynthesis completely dwarfs man's best achievements. As a phenomenon for fixing energy in usable form it is unique among the processes upon which he has come to rely. It is an unusual endothermic reaction in that it proceeds so easily to completion without requiring special conditions of temperature and pressure.

The chemical processes are rapidly being elucidated. Something of the magnitude of the processes involved in combining carbon dioxide and water can be visualized from investigations on $C^{14}O_2$, in photosynthesis. Within three minutes after plants are exposed to $C^{14}O_2$, some fifty-seven new compounds may be found bearing the labeled carbon atom. This dynamic process could not be duplicated by a chemist or even a staff of chemists in less than several weeks or months of careful synthesis.

Starting with very simple raw materials and radiant energy, the energy is fixed in readily digestible carbohydrates and amino acids. These can be stored until needed. The world of man's affairs awaits the duplication of this feat so that energy can be stored during daylight until it is needed at night. The use of cell-free extracts to implement this reaction looms more and more important as we proceed into the space age. Untold benefits could accrue in space travel if energy such as is being employed in solar batteries of space vehicles, or the man-made satellites of today, could be used to operate a photosynthetic process. This would permit the purification of the restricted spaces that may be occupied by a space traveler of carbon dioxide, the restoration of free oxygen for respiratory processes, and production of supplementary food. Once the secret is unraveled, man will be one step closer to controlling his environment and to escaping from its present confines.

The Environmental Effect on Plant Buds

The great seasonal cycle of development in plants is closely attuned to changes in weather. The buds of a tree remain dormant until the proper season, flower buds are not initiated haphazardly, and many other processes are attuned to seasonal development.

Many flowering plants set blossoms at specified seasons of the year. This is usually found to be dependent upon the length of day or a combination of day-length and temperature effects. Some plants can initiate the development of flower buds only when exposed to short days, while others require long daylight (ten to fourteen hours) and short dark periods. The photoperiod response restricts the use of plants to certain seasons and certain bands of geographical latitude. It is entirely conceivable that, if the photoperiod response could be broken, two crops could be grown in one season where only one is now possible, forage legumes and grasses could be encouraged

to continue vegetative growth in pastures, sugar cane could be discouraged from setting seeds so food reserves would accumulate fully as sugars in the cane rather than as oils and proteins in the seed. It has been shown by Dr. Philip H. Plaisted of the Boyce Thompson Institute that the yield of protein per acre in orchard grass could be doubled by preventing flowering, and the grass remain palatable for much longer periods of time. Pastures probably are producing no more than one-fourth to one-half of their forage potential.

The flowering response is dependent upon chemical messengers that are transferred from the branches that are exposed to the proper photoperiod treatment, to untreated branches in at least some plants. A chemical which would destroy or accelerate the production of such bud regulants might be used to free plants of their complete dependence upon photoperiod.

It has been possible to replace a couple of hours of sunlight by use of synthetic chemicals upon chrysanthemums. The chrysanthemum normally does not set flower buds until the periods of sunlight begin to shorten in late summer and early fall. The same effect can be achieved by repeatedly covering the plants with a dark cloth for two or three hours in late afternoon. There is substantial evidence that the chemical messengers involved may be replaced, in part, by synthetic chemicals.

On many plants and their seeds, the embryonic bud does not initiate vegetative growth until it has undergone a process of chilling followed by restoration of conditions favorable to growth. If peach seeds or vegetative buds on a seedling are not exposed to chilling, they fail to grow normally. The seedling grows for three or four inches, but the internodes never elongate normally so the stem remains telescoped to give a plant known as a physiological dwarf. If the seed is held at 5° C. for several weeks, or if the seedling is chilled to this temperature, the seedling will make normal growth when placed in soil at a temperature of 20° to 25° C.

Some sort of chemical change is responsible for physiological dwarfing in the *Rosaceae*. There is some evidence that this material is generated in the leaf primordia adjacent to the growing point and may be an inhibitor. More recently, light has been found to correct the physiological dwarfing. If the dark periods are interrupted with supplementary light, plants will make normal growth. It has also been shown that gibberellic acid will break the physiological dwarfing phenomenon. So far it has been impossible to detect an active plant regulant or to isolate a chemical that would be influenced by light, chilling, or gibberellic acid.

The Problems of Senescence

Plant growth starts off with a flourish, proceeds to differentiation of special tissues, and then declines into a senescent condition. Leaves of temperate-climate plants drop periodically, usually after a frost. However, a young red oak, if held in a greenhouse and supplied with completely balanced nutrient solutions, will go through several cycles in a year, irrespective of the climate outside. Some mechanism regulates the process so that it goes through a periodic cycle.

The shattering of blossoms and the falling of fruit are considered forms of senescence associated with maturation processes. The natural processes may be accentuated many-fold by removing the organ from the foliage-bearing stem. Because of this acceleration of senescence, the cut rose bud has been losing popularity for several years.

A careful study shows that the metabolism of the rose bud changes progressively during the first three days after the bud has been removed from the bush. First it digests free organic acids in its respiratory processes, then it exhausts the sugar reserves, next it deaminates the free amino acids. Eventually proteolysis sets in, that is, proteins are broken down into simpler compounds which are then converted to organic acids by deamination. The latter processes release considerable ammonia in the petal tissues, and this reacts with the cyanidin pigments which become purple in an alkaline medium. Here is the explanation for the change of color, or blueing, in red and orange roses after they have been in a vase for three or four days.

With the foregoing biochemical data, it is possible to visualize what should be done to delay or suppress senescence in roses. Dr. Leonard H. Weinstein found that if respiration was retarded by inserting the stems in weak maleic hydrazide solution, the acids and sugars were not exhausted so rapidly and the petals remained fresh much longer. As a matter of fact, if the maleic hydrazide solution was too concentrated, the bud never opened sufficiently to reveal the full beauty of the petals. By use of aluminum sulfate or other heavy metals to mordant the cyanidin-diglycosides, it was possible to prevent a change in the red color for periods up to two weeks. If a combination of maleic hydrazide and a mordant were used jointly and were reinforced with dextrose, it would be possible to double the vase life of a rose.

The Induction of Disease

Very few microorganisms are inherently destructive to plants. However, many of them produce cytolytic enzymes, toxins, or growth regulants that give rise to adverse symptoms in plants. The so-called "soft-rot" diseases, caused by bacteria and fungi which attack fleshy roots, rhizomes, and fruits, are produced by pectinase and protopectinase enzymes that dissolve the middle lamellae between cells and thereby destroy the integrity of tissues. The wilt-inducing organisms establish themselves in the tracheal tubes where they produce a variety of toxins that change the turgor of tissues.

Among the leaf-spotting diseases there are a number that cause necrosis, chlorosis, and abscission. Some of these, such as the cherry yellow-leaf fungus, apparently hydrolyze amygdalin and cause necrosis of a few cells so that there is a "shot-hole" effect. The wildfire bacterium of tobacco produces a large yellow halo around a relatively restricted spot of invasion. The halo is attributable to tabatoxin, a compound that has been separated and identified as a new amino acid by Dr. D. Wayne Woolley and Dr. Armin C. Braun, and their co-workers at the Rockefeller Institute for Medical Research.

One of the most interesting developments in modern plant pathology and physiology has been the studies on the nature of virus. In the twenty-five years since Dr. Wendell M. Stanley isolated and purified the virus of tobacco mosaic, it has been shown to be a nucleoprotein. The nucleic acid part

(Continued on page 180)

RADIATION: AN AID IN PLANT IMPROVEMENT

By **Seymour Shapiro**

Dr. Shapiro is associate botanist in the Department of Biology at Brookhaven National Laboratory, Upton, Long Island, New York. The research discussed in the following article was carried out at Brookhaven National Laboratory under the auspices of the U. S. Atomic Energy Commission.

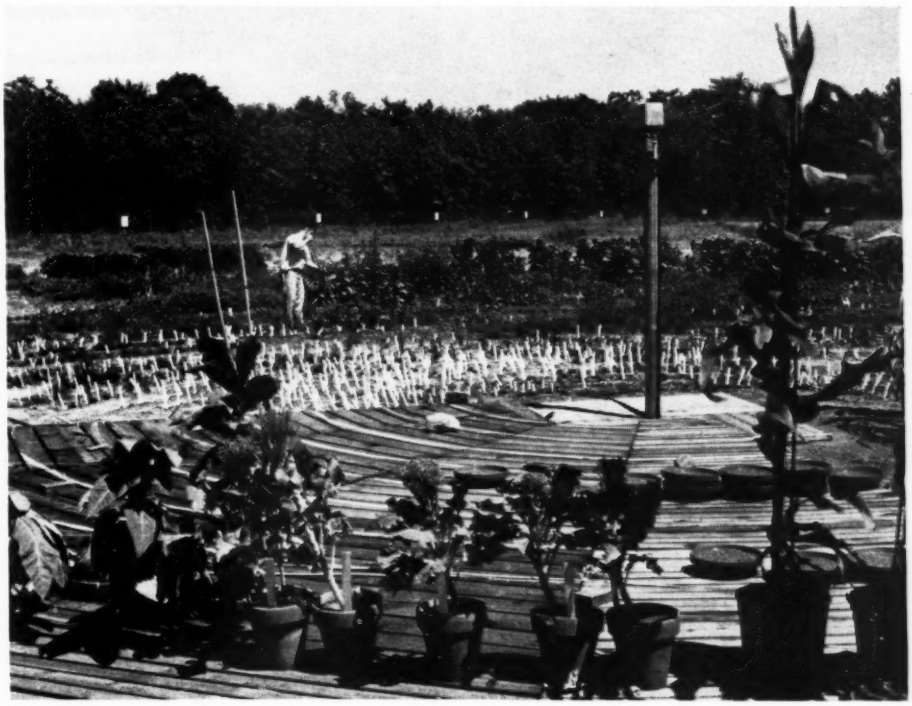
THE GOAL of plant breeding is to produce varieties of plants that are capable of performing certain functions in a more efficient manner than do varieties currently in existence. The plant breeder attempts to achieve this elusive objective (*elusive* because man's requirements and plant production problems are constantly changing) by manipulating genetic variability into a wide array of combinations of characteristics and then selecting those best suited to his needs. An important restriction placed on the efforts of the breeder is the natural limits of genetic variability. Among the factors that contribute to natural variation, hybridization and spontaneous mutation rank high. Man has used controlled hybridization as his predominant method of crop improvement. The truly enormous advances made in developing more efficient crop plants testify to the success that man has had with this approach. The second factor, mutation, has always been intriguing because of its contribution to the available pool of variability as well as for its fundamental significance in the process of evolution and in the science of genetics. Since the agents that are effective in molding the course of evolution are also applicable to plant breeding — which has been defined as evolution directed by man — mutations have been the subject of considerable scientific interest and intensive research. Eventual control of their occurrence and direction have long been a hope of both the geneticist and the plant breeder.

Mutation, defined as a structural alteration in the hereditary material (the genes) located within the nucleus of the cell, occurs suddenly and unpredictably. Although a number of such changes have resulted in desirable changes in cultivated plants, these fortuitous events occur infrequently and have therefore only rarely been a part of planned programs for crop improvement.

The first indication that one could experimentally increase the mutation rate came in the late 1920's from the researches of Drs. H. J. Muller and L. J. Stadler, working independently with fruit flies and barley seed, respectively. They discovered that by exposing their material to X radiation there was a substantial increase in the frequency with which certain obvious characteristics were changed to a different form. These pioneer efforts opened an entirely new and extremely profitable field of genetic research, for suddenly, for the first time, it was possible to produce mutations in large enough numbers to permit critical study. Scientists in several countries, particularly in Sweden, were quick to recognize the possible applications of radiation-induced mutations to the improvement of crop plants. The Swedish group has been singularly energetic in its exploitation of this new tool and has made important contributions to our understanding of the basic mechanism of the induction of mutations, as well as demonstrating practical, beneficial mutations in several crops.

This entire area of research received an enormous stimulus in the post-World-War-II period when radioactive isotopes became readily and abundantly available. At the Brookhaven National Laboratory (a private research institution operated under contract with the U. S. Atomic Energy Commission to study, in a broad sense, the interactions of radiation with matter) a cooperative program was established in 1952 to enable plant breeders and agriculturists in the United States to make use of a broad spectrum of

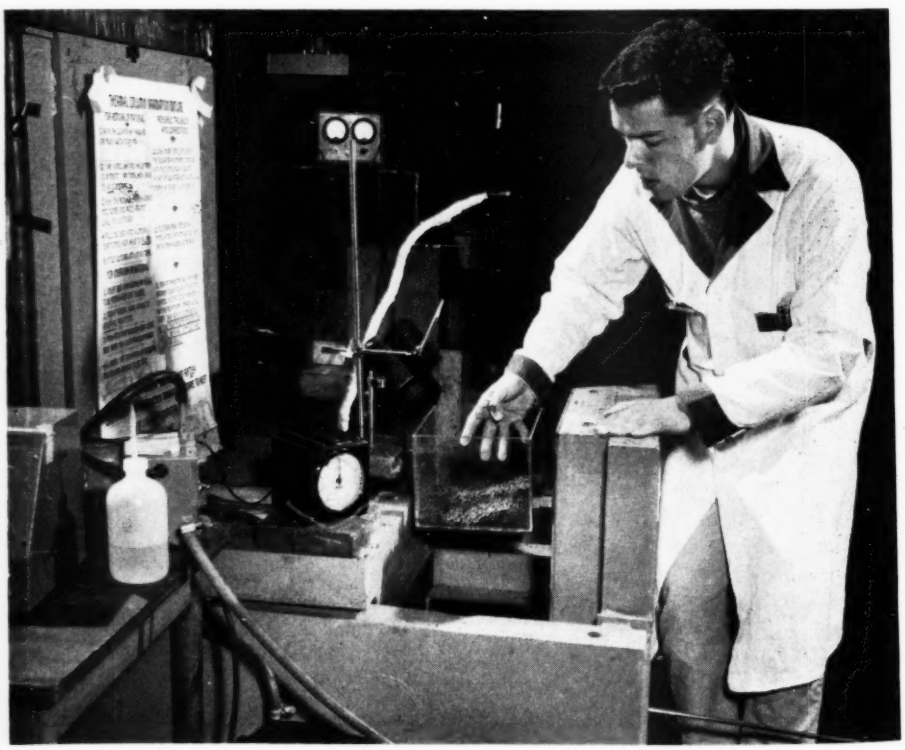
Plants in the two-acre Brookhaven Gamma Radiation Field. The 2,000-curie cobalt-60 radiation source rests in a protective shield below ground when observations are being made in the field. To expose plants to the gamma rays emitted by the cobalt-60, the source is raised into the hollow steel pipe seen at the right center of the photograph. An underground cable connects the source with a winch at the extreme edge of he field. Plants are exposed for twenty hours each day; those nearest the source receive the highest dose rates. For short-term exposures potted plants are set in position on the wooden platform. For long-term, chronic exposures specimens are planted directly in the field.



radiation techniques in their plant improvement programs. A similar project is also now in operation at the laboratories of the University of Tennessee Atomic Energy Commission Program. More than two hundred and fifty scientists in universities and agricultural experiment stations throughout the United States and in twenty-five foreign countries have participated in this work. The breeders consult with scientists at Brookhaven about their special problems and needs in any given crop and, if it seems likely that radiation may be successfully employed to produce a recognizable mutation for a desired characteristic, seeds, cuttings, and even growing plants are shipped to the Laboratory for treatment. Seeds and cuttings are generally exposed to thermal neutrons in the nuclear reactor, and also to X rays using a conventional X-ray machine. Growing plants are exposed for periods from one day to several months, or possibly even years, in a ten-acre radiation field which employs two thousand curies of the radioisotope cobalt-60 as a source of gamma radiation. The irradiated material is then returned to the cooperating plant breeder, who grows the plants and carefully screens them for the sought-after changes. Brookhaven is kept informed of the progress of the work, furnishes advice as required, and acts as a coordinating center in putting scientists with similar interests and problems in communication with one another.

How does radiation produce a mutation? What does it do to the cells of the plant to produce such a fundamental change? The determiners of development, called *genes,* are organized on and constitute a part of certain discrete structures, called *chromosomes,* which are within the nucleus of every cell of all plants and animals. In order then to change the pattern of inheritance, one must alter these genes or their arrangement on the chromosomes. Radiation, whether it be light, heat, X rays, neutrons generated in an atomic reactor, or the alpha, beta, or gamma radiation emitted by radioisotopes, is a form of energy, and energy is capable of performing work. With the exception of light and heat, all the radiations just mentioned are called *ionizing radiations* because they produce, either directly or indirectly, charged atoms called *ions* as they pass through matter. The effects I am here concerned with are intimately associated with this property of ionization production. When energy, in the form of ionizing radiation, is beamed through tissue, some of it will strike the chromosomes of the nucleus of one or more of the cells. In traversing the chromosomes some of the energy is absorbed, and this may result in a structural change in the molecules of which the chromosomes and genes are constituted. Depending upon such factors as the intensity of the radiation, the sensitivity of the site on the chromosome at which the radiation is absorbed, and the amount of energy absorbed, these molecular changes may or may not be microscopically detectable. Small alterations that may not be accompanied by any microscopically detectable changes may, however, be the cause of obvious changes in the growth and behavior of the plant. Such changes are called *point mutations.* Often, however, the amount of energy absorbed is sufficient to break the chromosomes, and the broken pieces can be clearly seen upon microscopic examination. Changes of this magnitude are called *chromosome aberrations.* Broken chromosomes may rejoin. Often several different chromosomes in the same cell may break, and rejoining of the broken ends may take place in combinations that are quite different from the original. A broken end of one chromosome may become joined to a broken piece of a second chromosome, and so on. Small fragments of chromosomal material may never rejoin and may become permanently lost to the chromosome complement. In these new relationships, with new "neighbors", the genes may express themselves differently, and new characteristics become apparent in the plant.

The interplay of all these factors, point mutations, chromosome aberrations of all sorts, and the consequent gene rearrangements and losses, creates a huge pool of variability which can then be sampled for particular combinations of advantage. The greater part of this newly created variability will be deleterious, and sterility runs high in such material. Most of the resulting plants will be discarded by the plant breeder. However, if one has specific objectives of improvement in mind and can employ accurate and efficient means of screening large populations so as to reveal the presence of the rare



Seeds, in a plastic container, are being put in position to be irradiated with neutrons in the nuclear reactor. The rod, seen below the technician's knees, will be used to push the plastic box onto a small elevator which will then be lowered partly through the reactor shield for exposure to the neutron beam.

An incomplete sport of the 'Masterpiece' chrysanthemum, a lavender-pink type. The sport, which comprises the left half of this flower, is an orange-bronze color characteristic of the 'Bronze Masterpiece'. Flowers arising lower on the stem from the same side as the orange-bronze half of this flower were completely of this color. Flowers arising from the right half of the stem were all of the normal lavender-pink 'Masterpiece'. In addition to the change in color, changes in petal size and form between the two halves of the flower are also noticeable.

individuals that carry the desired traits, then the sacrifice of large numbers of plants is of no great consequence. Such traits as improved flower color, increased or reduced plant height, changes in flowering or fruit-ripening time can be directly observed if they appear in the irradiated population. More subtle characters, such as disease resistance and drought or temperature tolerance, are not immediately obvious except as a response to a particular stress, and the scientist must use natural or artificially created stress conditions if he is interested in locating individuals with these characteristics in an irradiated population or in the progeny of an irradiated population.

From the previous discussion of the site of origin of the mutational event, it should be clear that when a mutation takes place it occurs in a single cell. This cell generally must divide a large number of times to produce enough tissue for the mutation to be recognized and used. Mutations that occur in cells that are not destined to divide further are almost never detected and are certainly of no practical use. If the plant is propagated by seed, the tissue derived from the mutated cell must extend into the flower and reproductive structures if it is to be detected and used. In plants propagated asexually (as by cuttings), the altered tissue must reach into a bud from which it can then be propagated and increased. Only a few seeds or a few buds first display the mutation. For this reason, the new type will generally appear as one branch, all or part of which is distinctly different from the remainder of the plant. From this initial appearance of the "sport," one must propagate a large enough population to permit a critical evaluation of the new type. He must determine whether the mutation differs from the original only in the single originally detected character, or whether this new change is perhaps associated with other alterations that might be disadvantageous. Some new traits may not be useful in the varieties in which they were discovered but must, by hybridization, be introduced into different varieties. One must therefore determine the means of inheritance of the new characteristic if maximum benefit is to be made of it.

In addition to its mutagenic properties just discussed, radiation may produce beneficial changes of a permanent sort by a different mechanism. Most plants possess the same genes in all of their cells. However, despite this fact, the expression of a gene depends upon the location in the plant of the cell that carries it. For example, although root cells contain the same genes for flower color as are present in the cells of the petal, only the color genes present in the cells of the petal have an opportunity to control the color of the flower. I must now qualify the statement that all cells of an individual have the same genes. Certain asexually propagated perennials, both woody and herbaceous, are known to have developed a condition in which certain tissues of the plant have cells that carry genes that differ from those in the rest of the plant. These two distinctly different sets of genetic material may exist side by side in a completely compatible and stable relationship. Such plants are known as chimeras, and a surprisingly large number of important horticultural plants are of this type.

In the course of some radiation experiments with the Sim Group of carnations, Dr. Y. Sagawa and Dr. G. A. L. Mehlquist, working at Brookhaven and the University of Connecticut, discovered that when plants of the variety 'White Sim' were irradiated with an appropriate dose of X rays or gamma rays, some sixty per cent of the irradiated branches produced red flowers rather than the usual white. In a similar fashion, irradiated 'Pink Sim' plants also produced large numbers of red-flowering branches. These red-flowering branches appeared in every respect to be identical with a third Sim variety, 'William Sim', and it was known that both 'White Sim' and 'Pink Sim' had originated as spontaneous sports of 'William Sim'. Breeding tests revealed that both 'White Sim' and 'Pink Sim' were chimeras and contained an internal core of tissue with genes for red flower color ('William Sim'). However, presumably by spontaneous mutation in one of the outer cell layers at some earlier time, these cells were now overlaid by tissue with

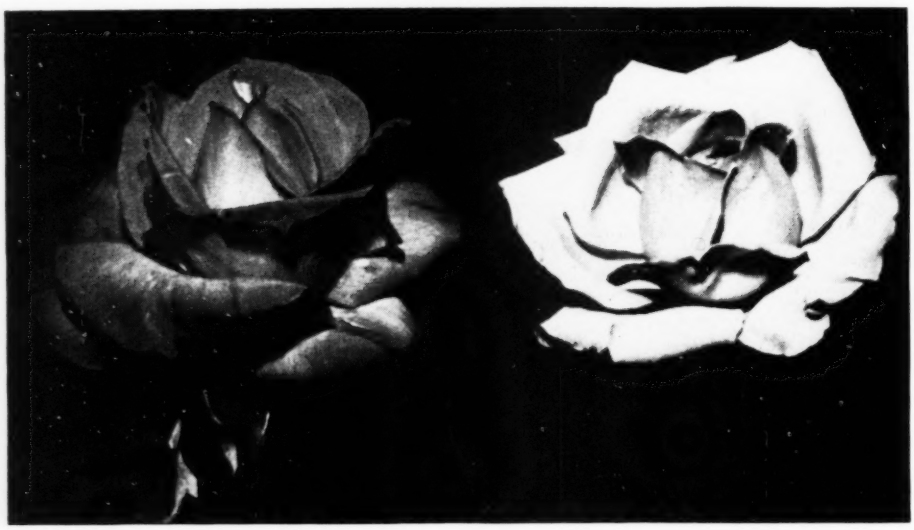
genes for the expression of white or pink flower color. As color in the carnation flower is located only in the outermost cell layer of the petal, only cells in that position are able to express their color genes. The conversion of the red-white ('White Sim') and red-pink ('Pink Sim) chimeras into red-flowering plants must somehow have permitted the core cells with red flower color genes to reach the surface and gain expression. An anatomical investigation by Dr. Sagawa revealed that the radiation treatment had selectively destroyed several of the outermost layers of cells at the stem growing point. These dead cells were sloughed off and replaced by cells from the central core of the stem tip, until a new and complete growing point was reconstituted. The chimeric nature of the branch was thus eliminated, and when the branch ultimately flowered, the previously latent red flower color genes were in the proper peripheral location favorable for their expression. This type of radiation effect is not restricted to carnations. Results similar to these have been obtained with chrysanthemums, roses, and geraniums, and it seems likely that this method will be extremely useful and will uncover the presence of numerous new characteristics, already present but masked in the plant.

I have reviewed some features of the history, the methods, and the theoretical basis for using radiation in the search for new and improved plants. What are the accomplishments of the radiation approach thus far? Among horticultural plants, those of primary interest to the present readers, a number of new and interesting types have been produced. At Rutgers University, Prof. L. F. Hough and his associates have been studying the effects of radiation on peach trees. Sports for both earlier- and later-ripening fruit have been found as single branches, or parts of branches, on trees of the varieties 'Fairhaven' and 'Elberta' that had previously been irradiated in the Brookhaven gamma radiation field. A late-ripening 'Elberta' sport seems particularly promising commercially. Some of the peach mutations have also resulted in firmer fruit flesh and changed fruit texture. In the variety 'Brackett' a sport was discovered from the normal freestone to the clingstone pit condition. Horticulturists at other institutions have reported fruit color changes in apples and pears, a larger-fruited muscadine, and disease-resistant currants.

In floriculture, Prof. G. A. L. Mehlquist of the University of Connecticut has selected several improved carnations from his radiation experiments, and these are now being evaluated under commercial growing conditions to determine their over-all suitability for release as new varieties. These selections include changes in color, flower form, and increased vigor of the plants. Flower color changes, largely because of the ease with which they can be detected, have been found in a large variety of species, among them being the African violet, cyclamen, phlox, snapdragon, tulip, rose, chrysanthemum, geranium, and petunia.

Since work was started earlier with agronomic plants than with horticultural ones, one can expect, and one finds, that the status of research with agronomic species has progressed further. Six new varieties have been released to the farmers of the world as a consequence of radiation experimentation. Three of these new varieties were developed and released in Sweden, the country first to initiate such studies on an intensive level. These radiation-produced varieties are 'Primex' white mustard, 'Regina II' summer oil rape, and the 'Weibull Stralart' fodder pea. A new bean, called 'Shafer's Universal', has been released in Germany, and the 'Sanilac' navy bean and the NC4X peanut are the results of efforts in Michigan and North Carolina respectively. In addition to those already on the market, a much larger number of potentially useful mutations are undergoing extensive testing and evaluation which will determine whether they are directly useful, useful when incorporated into other existing varieties, or of no value because of concomitant deleterious features from which the useful trait cannot be separated. Radiation-induced characteristics at this stage in development include dwarf forms of rice, sorghum, and barley with little or no accompanying loss of yield (but which render the plants less susceptible to wind damage); stiffer straw and altered grain-ripening time in a variety of small grains; disease resistance in wheat, oats, flax, peanuts, barley, and bluegrass; and increased yield in several different species. When one considers the relative infancy of research in this field, the long period required for testing selected mutations and sports, and the large number of still unanswered theoretical questions, the answers to which will undoubtedly increase the efficiency with which radiation is used, the results at this point seem highly encouraging.

'Better Times' rose at the left and one of its radiation-induced sports. 'Better Times' is a dark red rose; this sport is very pale pink with a slightly darker pink center. The sport is considerably lighter than either 'Briarcliff' or 'Columbia', pink roses present in the ancestry of 'Better Times'.



OPEN GARDEN DAYS

OCTOBER 18 and NOVEMBER 15, 1960

The New York Botanical Garden announces that these scheduled dates are the only ones when guided tours are available. Garden clubs, educational groups and individual members are welcome.

NEW GARDEN PLANTS

A discussion of some recent introductions and some less-known plants of proven garden merit.

By **James S. Wells**

Mr. Wells, who operates his own nursery at Red Bank, New Jersey, is the author of *Plant Propagation Practices.*

WHAT IS A NEW PLANT? You may think that this is a somewhat pointless question, but in a recent catalogue rhododendron 'Mars' was listed as a new plant, and to many growers it is. However, this variety was first raised in 1875 and has been available from rhododendron nurserymen for at least seventy-five years. This may be an extreme example, but it does emphasize that it takes a long time for a really new plant to become distributed, and that it can truly, perhaps, be considered a new plant for at least a quarter of a century.

Actually, so many varieties are available in almost any species, that the so-called "new variety" needs careful scrutiny before it is accepted as being worth growing. If a "new variety" is all we want, a handful of seeds of almost any plant will produce "new" varieties in profusion; but if we want a plant with distinct and improved characteristics that make it better than those we have been accustomed to grow, such a plant may be available.

Within recent years a number of plants, most of them new, one or two of them old and relatively unknown, have been presented to gardeners as worthy of their notice. Here is a résumé of some of the best in the current nursery catalogues.

One would hardly think that we need any more azalea varieties, for over fifteen hundred named sorts are available from nurseries in this country. Unfortunately many of these are duplicates, and there is room for really good azaleas in certain categories. In this northeastern area one of the criteria upon which a new azalea has been judged is hardiness. Will the plant stand our winters?

Secondly, does it have some characteristic of plant or flower that makes it more desirable than the standard variety in use? Judged on this basis, several varieties of azaleas are worthy of consideration.

Azalea 'Eureka', a U. S. Department of Agriculture introduction from Beltsville, Maryland, has proved to be extraordinarily hardy. It is an excellent replacement for 'Coral Bells', which is not hardy under normal garden conditions. 'Eureka' is a Kurume type, that is to say, broad and compact, with pale but clear pink flowers and a slightly deeper center. Its foliage is a glossy green.

Azalea 'Polar Bear' gives promise of being the hardiest compact white variety at present available. It is very much more hardy than the standard Kurume azalea 'Snow'. The flowers are hose-in-hose and of good substance. The foliage is a glossy green as opposed to the rather dull green of 'Delaware Valley White' or *A. ledifolia alba.* 'Polar Bear' is also a U. S. Department of Agriculture introduction.

Joseph Gable of Stewartstown, Pennsylvania, has originated a number of rhododendrons and azaleas of outstanding merit. Three are now coming into general use as really first-class, hardy azaleas. The first is a pale pink, completely double-flowered variety called (most aptly) 'Rosebud'. It is not, in the strictest sense, a new plant because 'Rosebud' has been offered for some time, but it is only now coming into general use. This charming plant is usually in full bloom for Memorial Day and therefore extends the natural azalea season by some two to three weeks. Azalea 'Lorna' is another Gable variety, even lower and more compact than 'Rosebud'; its flowers are a somewhat deeper pink with a slight touch of mauve. It is a very pleasing plant and above all completely hardy. Mr. Gable's best hardy red azalea is called 'Stewartstownian'; the red is a true blood-red with no tinge of purple or magenta. The plant, a Kurume type, quite compact, is exceptionally hardy and is clearly superior to other red varieties such as 'Addy Wery', 'Sherwood's Red', and *A. obtusum* var. *hinodegiri.* The leaves are a dark glossy green, and the stems turn to quite a deep brown-red.

I recently acquired a plant of *Cotoneaster dammeri,* and from all accounts it appears to show possibility as a most interesting groundcover. It is completely prostrate, running flat along the ground and rooting vigorously at the joints where the stems come in contact with the soil surface. It has insignificant little flowers in the axles of the shiny green leaves, and these are followed by bright red berries in the fall. *C. dammeri* appears to be completely hardy in this northeastern area; the plant which I acquired came to me from Canada where it is growing without difficulty. This can not strictly be called a new plant, yet it is not generally available. If acquired, it will, I think, prove of real interest and value to the home gardener.

Another interesting introduction from Canada is the lovely hybrid daphne 'Mertensiana'. This plant, a little shrubby evergreen, is somewhat similar to daphne 'Somerset' but retains its leaves through the winter except under very severe conditions. Each stem is tipped in spring with a cluster of very fragrant, deep pink flowers; not spectacular in form but attractive and particularly so from the point of view of scent, an almost neglected garden attribute which I think any keen grower should try to provide in his garden. The plant does need a little protection, particularly when young, because the tips of the new growths that are made in the fall seem to be susceptible to winter wind injury. Evergreen boughs, placed in the ground to arch over the plant, will furnish light protection and assure its coming through the winter without damage. This is one of the few shrubby evergreen daphnes that are available to us in this area.

Two excellent magnolias have been recently introduced. The first, *Magnolia stellata* 'Royal Star', grows in a manner similar to *M. stellata* but has the most useful attribute of flowering two or three weeks later. This means that the flowers, which are borne in profusion on the young plants, are usually free from frost damage, an important point for the proper enjoyment of this plant in the springtime. Magnolia 'Dr. Merrill', an introduction from the Arnold Arboretum, is a cross between *M. stellata* and *M. kobus.* It forms a vigorous tree, rather similar to *M. kobus* but with a much heavier blooming habit. Magnolia 'Dr. Mer-

rill' is a tree for a fairly large area, because it will eventually reach twenty-five to thirty feet in height and probably ten to fifteen feet across. It is most pleasing in leaf and in flower and has a distinct value.

Another interesting introduction from the Arnold Arboretum is *Prunus* 'Hally Jolivette' raised by Dr. Karl Sax. This is a really delightful plant for any garden, large or small. It is somewhat similar to *Prunus triloba flora plena* but has a much daintier habit of growth and flowering. *P.* 'Hally Jolivette' ultimately forms a shrub, maybe six to eight feet high, although it can be pruned to a lower height. It is completely hardy and would probably be so under much more extreme conditions than are prevalent in this area. In addition, it has one quality which endears it to me greatly, that is, the flowers are produced for nearly a month in spring. Last year I noticed that the first blossom on the plant in my garden opened on April 12. As spring advanced, the quantity of blooms steadily increased; all the while the semi-double flowers, which are borne on long pedicels, were continually being produced from the tips of the stems, and flower buds were coming out. This means that the heaviest display of blossoms is probably to be had around May 1. I can heartily recommend this hybrid flowering almond to any gardener who wants something a little different and interesting for early in the spring season.

Rhododendrons are of particular interest to me. There is, of course, a tremendous number of new varieties coming along, but I shall mention only three that have been introduced and should be available in certain well-stocked garden stores here in the East. These three are a selection from the numerous Dexter Hybrids which were raised on Cape Cod in Massachusetts by the late C. O. Dexter. These rhododendrons have a very mixed and, unfortunately, unknown parentage. Tens of thousands of seedlings were distributed by Mr. Dexter to all parts of the country and a committee is now attempting to evaluate and select from this vast material those that seem to be clearly superior. One of these seedlings has been selected and named 'Scintillation'. The original plant grew for many years in the Dexter collection at The New York Botanical Garden, where it was observed and remarked upon by growers throughout the East. Unfortunately, a terrific flood one summer completely destroyed the original plant, but young material had been established in one or two nurseries and 'Scintillation' is now being propagated and distributed. In my opinion, this rhododendron has almost all the qualities of a really first-class plant. It is delightful to look at in or out of bloom, and completely hardy; it was untouched by the rigors of the extreme winter of 1958-9. The leaves are large and a deep glossy green, unusually fine foliage in a group of plants renowned for their good foliage effect. Finally, the plant produces massive trusses of clear light pink flowers, each of which has a yellow cast in the center of the trumpet. As if all this were not enough, the plant, which is a cross with *Rhododendron fortunei,* has a natural fragrance; not strong (this is true of any of the fragrant rhododendrons), yet sufficiently discernible and distinctive to be enjoyed by the gardening connoisseur.

The standard set by 'Scintillation' is difficult to match, and the two other Dexter Hybrid rhododendrons that are being propagated do not quite equal 'Scintillation' in all respects. 'Morris #3' has been selected from the group which is growing at the Morris Arboretum in Philadelphia. The luminous quality of its deep rose-red flowers has justified its selection and propagation. The habit of growth is not as good as it should be, in that the plant can become leggy if it is not pinched and cared for so as to construct a well-formed bushy plant. Given this structure however, 'Morris #3' plant will develop satisfactorily. A third Dexter is still being grown under the number 62, although I am sure it will shortly be named. This came from a group which Mr. Dexter sent to Seattle, Washington. The leaves resemble those of 'Scintillation' in being large and a glossy green. The flowers which open a light cream and fade to a rich off-white, have a yellow center. The young unfolding buds are a light pink. As the flowers develop, the pink buds surmount the opening cream flowers and their yellow centers—a most unusual color combination; and as an additional attraction, the flowers are fragrant.

I must not overlook the foundation evergreens, such as yews. There are two excellent varieties with distinct qualities that justify their inclusion in any good garden planting. The first is *Taxus cuspidata nigra.* This spreading form of *T. cuspidata* has an almost black-green foliage. Even under adverse growing conditions this dark green color persists. The plant has the natural stamina and vigor of growth of *T. cuspidata,* and as its color is so much better, there seems to be no point in continuing to grow the more ordinary form. A second variety of *T. cuspidata* is *densiformis.* This is a semi-upright or should I say semi-spreading form which lives up to its name, for it is dense, relatively compact, and yet vigorous in growth. *T. cuspidata densiformis* can be trimmed to make a very fine medium-size hedge plant, or it can be left to grow into a really excellent specimen of unusual compactness; yet this compactness is combined with vigor which takes it out of the really dwarf class. For a dwarf yew, there is *T. cuspidata nana.*

Finally, I come to two flowering shrubs, two viburnums, both relatively recent introductions and both excellent. Most of my readers probably will have seen or grown *Viburnum carlesi,* a pleasing shrub which produces large round heads of creamy white flowers, deliciously fragrant. A compact form of this has been raised by a nurseryman in Rhode Island; it is covered with similar heads of fragrant blossoms, and for the modern home and the small garden is a desirable subject. Where more space is available, then the hybrid *V.* 'Carlcephalum' is well worth growing; a cross between *V. carlesi* and *V. macrocephalum,* this is a vigorous plant with dark glossy leaves and really large heads of fragrant blossoms.

I close this brief review of some of the newer and better plants that are currently available, by looking ahead at some of the things that may be offered in a year or two. Recently I was shown a picture of a new clematis, an improved form of the hardy *C. montana rubens.* This has much larger and deeper pink flowers and a greater vigor of growth, if this is necessary, for *C. montana rubens* grows vigorously enough. The size of the bloom brings

(Continued on page 177)

PERENNIALS:

An Evaluation of Their Cultural Requirements

By Andre Viette

Mr. Viette is lecturer, horticulturist, and manager of the Martin Viette Nurseries, a seventy-acre establishment at East Norwich, Long Island, devoted to herbaceous perennials. He is mainly interested in the pollination of hemerocallis with emphasis on the use of colchicine, and the breeding of Lobata and Early Hybrid peonies on the later Albiflora Hybrids. Tests are being conducted, under the supervision of the Cornell Ornamental Research Laboratory at Farmingdale, with different chemicals to determine the phytotoxicity of plants and the control of various weeds.

Aster alpinus 'Goliath', with large flowers of light blue-purple, may be used in the rock garden or in the foreground of a perennial bed.

IN THE PAST considerable emphasis has been placed on the proper selection of perennial plants rather than on their cultural requirements. Because of the fallacies about perennial culture, it is important to have a basic understanding of the relations between plant and soil.

The old idea of duplicating as closely as possible, in culture, the soil conditions of a plant's natural habitat is at times the wrong approach, for a number of plants thrive on soils different from those of their normal habitat environment. A good soil structure prepared to a depth of two to three feet in the garden has proved more beneficial. Using peat instead of humus in the soil has resulted in the better growth of many woodland plants. Applying water and nutrients has also been helpful. Many plants (halophytes or cacti) only tolerate their natural ecological conditions and grow much better when planted in good garden soil.

Organic materials have been applied and worked into the soil for generations. Manure has probably been used more than any one other organic material, but it has disadvantages as well as advantages, and its use in gardens has lessened as its disadvantages have come to light. Manure improves the structure of the soil and increases its capacity for water infiltration and the bacterial count. The increase of microorganisms is an advantage in the breakdown of organic material; but when microorganisms multiply to a great extent, some compete seriously with the plant roots for oxygen. When high applications of manure have been worked into the soil, a condition of low oxygen and high carbon dioxide may result in a decrease of root growth. The lack of oxygen is also likely to impair the absorption of water and nutrients.

The fertilizing value of manure has been overestimated; fresh cow and horse manure have a total fertilization content of only one or two per cent. My own experience has shown that when large amounts of fresh manure are applied, the plant may die through poisoning of the roots or gassing of its upper part.

The weed-seed content of manure is very high. After manure has been applied to relatively weed-free soil, I have seen a vigorous crop of assorted weeds appear. When fresh manure is used, flies and odor may be other problems, and there is a much higher incidence of disease in a perennial garden.

One of the greatest disadvantages of fresh manure is its rapid rate of decomposition. In preparing a soil medium the gardener wants an organic material that will last for a long period. If fresh manure is used, the soil will have lost most of its good structure at the end of two years. Well-rotted manure is less harmful in some respects than fresh manure.

Artemisia schmidtiana nana forms a pleasing low mound of fine silver-grey leaves.

Tiarella wherryi bears pale pink flowers above attractive heart-shaped leaves.

Sawdust has come into use within recent years. Since it consists mostly of high amounts of carbohydrates, it may bring about a rapid increase in certain microorganisms, which results in nitrogen deficiency. This depression of nitrates is caused by soil microorganisms consuming the sawdust as food, and the condition must be remedied by applications of a nitrogen fertilizer.

Leafmold and composts are organic materials that may be acid or alkaline, depending upon their origin. They decompose relatively quickly, although not so quickly as fresh manure. They improve soil structure and are relatively low in fertility.

Peat improves the soil structure but is extremely low in fertility; fertilizer should be added with it. Because I want my garden to last from four to ten years, I select an organic material that will endure for that period. For this reason I choose peat as the best organic material. The acid effect of peat is beneficial for acid-loving plants in a woodland garden, and with the applications of limestone peat is a fine organic material for lime-loving plants.

Once a soil decomposes, the gardener cannot improve it greatly from above the surface; he is then compelled to redo the whole garden.

Organic fertilizers may be fast-acting or long-lasting. In this article, I am discussing organic fertilizers which break down slowly. Nitrogen can cause erratic differences in the vegetative growth of perennial plants. With high-nitrogen organic fertilizers, plants of soft, succulent growth and few flowers frequently develop; such plants are usually more susceptible to injury from disease. Application in late spring of high-nitrogen organic fertilizers which break down slowly may cause plants to be soft and succulent as they enter winter.

Application of acid fertilizers is not necessary on most acid soils, such as those of Long Island; there is no need to make soils of pH_{4-6} more acid than they already are. Although in such soils there may be some deficiency in the minor elements, the latter are usually present in sufficient quantity for good plant growth.

Vitamin B is not needed as a fertilizer additive. It is synthesized by the plant, but it is not absorbed by the roots.

The best fertilizer for perennial plants is one that is low in organic content and low in nitrogen, such as a 5-10-5,0% to 20% organic which has a lasting effect of three to four months in the soil.

Hostas are planted primarily for the effect of their foliage. Above. *Hosta sieboldiana.* Left. *H. fortunei viridis marginata.*

Most perennial plants thrive in a loam soil that has adequate drainage, aeration, and water-holding capacity. It would be impractical, because of the labor and time involved, to prepare a special soil medium to meet the ecological requirements of each kind of perennial plant; one is prepared that will benefit the greatest possible number of perennials in the garden.

The following is a basic method for the preparation of a herbaceous border, rock garden, or naturalistic planting. For a garden in the shade two to four inches of peat are placed on the surface of the soil. No limestone is used, since most of the shade plants grow best in $pH_{4.5\text{-}6.5}$. Thirty pounds of 5-10-5 fertilizer per one thousand square feet are spread and with the peat worked in well to a depth of one foot. For a garden in the sun two inches of peat are placed on the surface of the soil. Thirty pounds of 5-10-5 fertilizer and fifty pounds of limestone per one thousand square feet are worked in well to a depth of one foot. The amounts of fertilizer and lime will vary with the nature of the soil.

With some exceptions, perennial plants may be moved at any time of the year — during bud initiation, bud development, flowering, or post-flowering period. The best time to divide perennials varies from one plant to another, early spring and early fall are, however, the safest periods for the propagation of most perennials by division.

Many people water lightly with a hose day after day after planting, a process which results in an extensive root system forming at the surface of the soil and a poorer root system at a greater depth. These surface roots are subject to drought in summer and freezing in winter, and as this practice discourages deep rooting, the plants may die. Even more damaging to perennial plants is the recommendation made by some growers to water continually and heavily day after day and week after week after planting. When the soil moisture has reached a level considerably above the wilting point, further watering is likely to be not only wasteful and without any useful effect, but actually detrimental to the plants. A good soil structure is one in which the organic material, including the soil colloids, has a high waterholding capacity and a fair amount of pore space to ensure good drainage and aeration. The important water for plant growth is not the gravitational or drainage water that is applied in watering, but the water that is held in the soil after the excess has drained. Drenching the soil continually will keep the pores filled with water; a deficiency of oxygen may result and affect the respiratory process of the root. Toxins may build up, and death of the plants may follow. The less the oxygen content, the less the absorption of water and nutrients. After the initial thorough watering after planting, enough water is present in the soil for all the vital processes of plant growth until the condition of the soil indicates the need for water.

The correct procedure is to water gently with a sprinkler and to great depth. Gently watering is imperative so that the soil structure is not destroyed. There is no rule for watering, since this procedure depends upon the amount of rainfall. During a period of adequate rainfall in the spring, watering

Polygonatum multiflorum with pendant white flowers is one of the most appealing of the spring-blooming perennials for a shady or naturalistic planting.

Above. *P. multiflorum* with *Epimedium alpinum* (lower left), *Tiarella wherryi* (center), and *Primula acaulis* (lower left).

Right. Close-up of *P. multiflorum*.

may not be required at all. During dry spells, watering may be required once a week on heavy soils, and every four days on lighter soils. It may be done at any time of day; however, watering in the afternoon and evening is not advisable because of the disease problem.

Incipient wilting will occur even when water is readily available to the plant, if the rate of loss exceeds the rate of absorption. Watering cannot offset this physiological effect, since there is already plenty of water in the soil. This transient wilting is not detrimental to the health of the plant and should not alarm the gardener.

There are two basic types of mulches —winter mulch and permanent mulch. A winter mulch is a material, such as salt hay, which is applied in late fall to shade the ground and to keep the alternate freezing and thawing at a minimum until it is removed the following spring. A permanent mulch remains on the surface from year to year. It protects the soil structure, prevents erosion by wind and rain, conserves soil moisture, and controls weeds. The advantages of a permanent mulch are frequently publicized, but the disadvantages are very rarely made known. The warmer non-frozen soil beneath a permanent mulch attracts mice, and they may damage certain plants. Fire may be a hazard with some dry mulches. When a peat mulch becomes dry, it is impermeable to water, and the water runs off to outlying areas with plants in the garden receiving little of it. If the mulch becomes moist, it absorbs most of the water and holds it with great adsorptive tension, rendering it unavailable to the plant. The water later evaporates quickly, with little reaching the plant roots. If the peat is kept continually moist, it will promote a condition beneficial to root growth, and the peat will then become part of the soil medium rather than a mulch. Death of many shallowed-rooted perennials can result from the drying and freezing of the roots. Fresh sawdust (if it contains less than one and a half per cent of nitrogen) as a mulch may result in a nitrogen deficiency; decomposed sawdust may provide a finely particled medium in which roots may form. A mulch will buffer the soil temperature and keep the soil warmer later in the season; with certain plants, this may result in a soft growth later into fall. Buckwheat hulls have a neat appearance, but some toxicity to shallow-rooted perennials has been noted. Weathered buckwheat hulls that are relatively non-toxic in effect should be used.

Euphorbia myrsinites, a fleshy, decumbent perennial, will trail over a sunny rock wall or may be planted in full sun in a rock garden.

Manure has been used as a mulch for lawns, perennial gardens, and roses for many years, but its disadvantages outweigh any possible advanatges. It seeds the garden with many weeds, it may be directly or indirectly toxic to the roots, and it may cause an oxygen deficiency. Incidence of disease has been much higher when a mulch of manure has been used on iris and peonies. Perennial plants must be lightly mulched, for raising the level of the bed or border after they are planted may be detrimental.

A good mulch must fill the following requirements: 1) It must allow most of the water to pass through it, absorbing very little. 2) It must act only as a mulch, not as a soil medium, and be coarse enough to inhibit root growth in it. 3) It must not be toxic. Many mulches fulfill these requirements, such as leaves, non-toxic seed hulls of many types, coarsely ground corncobs, wood chips, sugar cane, and gravel.

Some Unusual Perennials

There are many unusual plants for perennial borders, rock gardens, and woodland plantings, and today, thanks to hybridizers, a wide selection of outstanding cultivars which add color, flower size, and vigor to the perennial collection. I use the term "unusual" for those plants which are not readily available at local nurseries; here are a few which I recommend.

Euphorbia myrsinites is a hardy prostrate perennial, with spiraled leaf arrangement and yellow flowers in umbels. Its main use is in the rock garden or trailing over a rock wall. *E. myrsinites* prefers a well-drained soil and full-sun exposure. It has no major insect or disease problem. If the plant becomes too straggly, it may be cut back to the center of the clump; but care must be taken in doing this, since the sap may be irritating to the skin.

Polygonatum multiflorum is a fine spring-blooming plant, with pendant

white flowers, which may be used in a naturalistic or shady garden. It prefers light to medium shade, although it will grow in the extremes of full sun or very deep shade. It requires a peat or humus soil and adequate moisture. The foliage of *P. multiflorum* furnishes a fine foil for cut flowers of annuals and perennials in flower arrangements. This plant, approximately thirty-six inches in height, has few insect and disease problems.

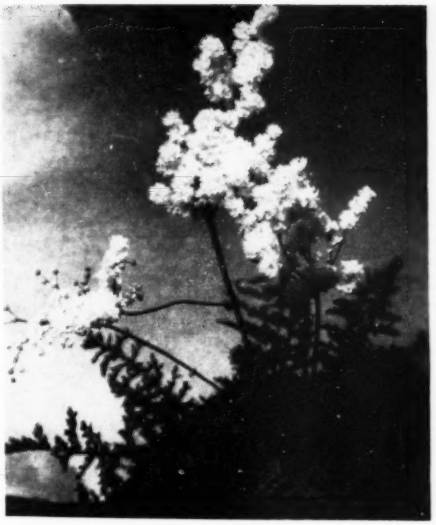
Aster alpinus 'Goliath' requires full-sun exposure and a well-drained, medium-loam soil. It is suitable for rock gardens and the border of herbaceous perennial gardens. This form of *A. alpinus* bears large flowers of a light blue-purple around June 1.

Artemisia schmidtiana nana is a silver-gray perennial which grows to about ten inches high. It is attractive in the border of a perennial garden or in a rock garden. This fine foliage plant, relatively free from insect pests and diseases, grows best in a well-drained loamy soil.

There are many species and varieties of *Hosta* (*Funkia*)—and much discussion about the correct species names. The hostas or plantain-lilies are very adaptable plants. They grow best in light shade, but will tolerate deep shade and full sun. They prefer a soil of good organic content and adequate moisture, but will tolerate dry or very wet conditions. They may occasionally be attacked by slugs. Hostas are used mainly for their foliage in different colors from blue to green, including variegated forms. They have lanceolate to spatulate and round leaves (from one inch to as much as one foot wide). The flowering period of the numerous species and varieties extends from June 15 until frost. The flowers are lavender or white.

Tiarella wherryi is a fine plant for a shaded rock garden or a naturalistic planting. The foliage is about six inches high, and the pale pink flowers reach a height of ten inches about May 20. *T. wherryi* does not creep as does *T. cordifolia*. It grows best in a humus or peat soil of adequate moisture and is little troubled by diseases or insects.

Filipendula hexapetala flore-pleno is a perennial with fern-like leaves; it produces airy white flowers about June 1. This plant, which is well adapted to the border and rock garden, grows



The airy white flowers and fern-like leaves of *Filipendula hexapetala flore-pleno* add a nice touch to a perennial border or a rock garden.

about twelve inches tall in full sun and about twenty inches tall in shade. *F. hexapetala flore-pleno* does best in a soil of moderate organic and moisture content, but will tolerate light soil and dry spells.

PERENNIALS (from page 172)

this plant up to that of the hybrid French clematis, and this improvement, coupled with the natural stamina and quality of the original plant, make it a "must" for anyone with an arbor for climbing plants.

Two beautiful hybrids of cytisus or Scotch broom, called 'Hollandia' and 'Zeelandia', have been produced in Holland. These are just coming over to this country, and because of the problems of re-establishing the stock plants here, may not be available for some time. They have been raised by a planned program of plant breeding in Boskoop and would appear to be completely hardy and a real "break" in color and form. They are red with an orange keel.

This spring was particularly fine for rhododendron flowering, and I took advantage of the opportunity to see some of the large established blocks of test seedlings growing here in the East. I was truly astonished at the quality of some of the finer plants. Some had beautiful peach - and - apricot - colored flowers, with trumpets almost as large as those of a lily; others had very full trusses of apricot-colored trumpets, deeply fragrant, and with an outstanding quality found in few plants of such size. Then there are the Shammarello Hybrids raised by A. M. Shammarello of Cleveland, Ohio, who has concentrated on the production of hybrids from 'Cunningham's White', 'Boule de Neige', and the native *R. catawbiense*. His breeding program has resulted in a wide selection of early, midseason, and late-flowering hybrids of compact form. These are particularly fine, and from the hundred or so numbered plants now being tested I can confidently state that probably twenty-five or thirty really outstanding plants will ultimately become generally recognized. One hybrid in particular struck me forcibly this spring. It has been named 'Belle Heller', and is a strong-growing rhododendron with an excellent constitution and very large trusses of creamy white flowers with a bright yellow throat. That there are other rhododendrons of this same description I am well aware, but I doubt whether there are any with the hardiness that these plants have.

While they are waiting for the newest plants to be distributed, may I suggest that my readers inquire of their local retailers for some of the new and better plants described above. None of them will prove a disappointment!

A Country Housewife's Garden

By Gertrude B. Foster

Mrs. Foster is Editor of
THE HERB GROWER MAGAZINE

IT IS STRANGE that anyone would want to photograph coriander, *Coriandrum sativum*, for a television commercial. The herb has been known in the food trade for centuries, but it is little grown in home gardens. The slim plant bears round green fruits which later turn light brown when ripe. All parts of the green herb have a strong pungency which is considered disagreeable to American senses. The ripe seeds, however, become pleasantly aromatic when dried. The loose umbels of pink-

(Continued on page 188)

CONSERVATION AND USE OF WOOD CHIPS

By **Homer L. Jacobs**

The following is based on the talk that Mr. Jacobs, Vice President of Research and Development of The Davey Tree Expert Co., gave at the thirty-fifth National Shade Tree Conference.

Balled trees are assembled in specially constructed bins. These are being filled with wood chips. Photo taken in 1955 at the Davey Technical Service Center in Kent, Ohio.

THE VALUE of humus, or other organic materials is too well covered in literature on soil improvement to be given further attention in this discussion on the conservation and use of wood chips for mulching and for incorporating directly into the soil. In what I have to say, there is no intent to disparage any commercial form of humus. All are good, and in an expanding — exploding — humus-starved "Levittown" culture, all available materials should be used.

Paul F. Frese in a handbook on mulches (*Plants and Gardens,* Vol. 13, No. 1, Spring 1957) lists twenty-two organic materials for this purpose. At least half of these are commercial materials, some produced for nearby sale only, while some, such as peat moss, are often sold at great distances from the point of production. Other organic materials could be listed; also such products as asphalt emulsion, cellophane flakes, plastic film, gravel, glass wool, and vermiculite.

Wood chips are the tree-man's product, and many thousands of cubic yards of this usable organic material are piled up each week from the four thousand or so wood chipping machines that are in operation in the United States and Canada.

A number of superintendents of parks, of botanic gardens, and arboretums, and those responsible for the planting and care of trees along city streets use large quantities of this by-product of tree-removal for mulching and soil improvement. But consideration should be given also to its use in home gardens, on larger landscaped areas, and in nurseries.

No great amount of technical information is available on the properties of wood chips in soil improvement. Most of the information on wood fragments is found in literature on the use of sawdust. F. E. Allison and M. S. Anderson in their *Use of Sawdust for Mulches and Soil Improvement* (U. S. Dep. Agr. Circ. 891. 1951) state, "Although the emphasis is on sawdust, this material differs little from other wood wastes, such as chips, shavings, and bark, except that decomposition is more rapid in the more finely divided materials and the absorbing power, when sawdust is used as a bedding, is higher." And again, "Since the percentage of bark, buds, and leaves in tree-pruning chips is often high, nutrient content is likely to be a little higher than that of sawdust."

A. A. Lunt in *The Use of Wood Chips and Other Wood Fragments as Soil Amendments.* (Conn. Agr. Exp. Sta. Bull. 593. 1955) brings the subject more nearly up-to-date and adds some basic information on the composition of wood chips.

Authors of literature on the agricultural use of sawdust and other wood wastes find it necessary to dispose of two popular misconceptions about these materials: one, that wood fragments incorporated in the soil are "toxic" to crops planted in the mixture; the other, that sawdust "sours the soil."

There is a little evidence that walnut and cedar wastes at times have some harmful effects on other plants. However, the general fear of toxicity results from the severely depressed growth that follows mixing sawdust or wood shavings into the soil without adding enough nitrogen to supply the crop, and to nourish the fungi and bacteria that are active in the decomposition of the woody material. It is recognized that mixing sawdust into the soil temporarily depletes the supply of nitrogen available to the crop. Lunt found that when supplemented with sufficient nitrogen, wood chips did not decrease the first-crop yields and generally increased yields of succeeding crops. This has been the general experience of others using sawdust or wood shavings.

Allison and Anderson point out that while most kinds of sawdust are mildly acid, this is generally of minor importance; when applied to acid-requiring plants, such as blueberries and azaleas, this slight acidity is beneficial. They further state that the final effect on soil reaction is negligible but is actually toward alkalinity. We all realize this when we remember that wood ashes are alkaline and that completely decayed wood retains about the same elements as those found in ash.

I tested screened material from a bed of chips two feet deep established in September 1955. Nitrogen fertilizers, usually acid-reacting, were applied from time to time and fresh chips were added once or twice a year to maintain the two-foot level. These screenings, representing the wood in the most advanced stage of decay, had a reaction of $pH_{6.6}$ in July 1959.

In the last seven or eight years I

have used some two thousand cubic yards of wood chips on plants under my care. Some of these have been used as mulch on shrubs and trees at the Davey Technical Service Center in Kent, Ohio, on soil that is quite sandy and exceptionally well drained, both on the surface and underneath. I have used fresh chips as a mulch in shrubbery borders and beds consisting chiefly of azaleas on my own home grounds. A heavy mulch was used on new tree plantings in a less well-drained clay soil, a few miles from Kent. In all these places, the chips appear to serve adequately the customary purposes of a mulch: to prevent extremes of soil temperature in the upper layers; to prevent compacting and facilitate the entrance of moisture; to conserve moisture by preventing surface exaporation; to discourage weed growth.

Park superintendents and others who use large quantities of chips for soil improvement report on composting them with soil and other amendments to prepare them as an enriched planting medium. Grape growers of Hammondsport, New York, used eight thousand tons of maple chips on the eroded, worn-out soil in their vineyards. Broadcast over the land at the rate of twenty tons or more per acre, the chips were later plowed into the soil, with the addition of one hundred and fifty pounds of ammonium nitrate per acre. During a four-year period production increased to as much as "seven tons of grapes per acre from vineyards that once hardly produced a ton per acre."

Use of wood chips at the Technical Service Center in Kent proves that not only do the raw chips as they come from the chipper provide a medium in which tree-moving stock can be held, but one in which trees can be grown for years — with no additions other than supplemental nitrogen, water as needed, and the control of high temperatures as to be described later.

Before the growing season of 1955, a few balled trees were assembled on the Davey Technical Service Center grounds. In September 1955, another seventy-five trees were accumulated in the same area. Other trees have been brought in at irregular intervals to a total of about one hundred and eighty specimens. Fifty remained in place in July 1959. To receive these trees, large bins were formed of 8 x 8 x 16 (inches) concrete blocks, spaced eleven inches apart and three blocks high. This made walls twenty-four inches high with many openings, yet sufficiently solid to retain wood chips. The trees were set in the enclosed area and chips filled in around them as they were delivered. Fresh chips were added from time to time as the bulk was reduced by decay. The surface on which the trees were set was a graveled parking lot with slope sufficiently uniform that the area was well drained.

Thirteen kinds of trees have been held in this way for varying intervals of time during five growing seasons. Trees considered both easy and difficult to transplant have been included: red, sugar, and Norway maples; pin oak; littleleaf and Crimean lindens; American mountain-ash; American holly; sweet gum; shagbark hickory; Chinese chestnut; European beech; and flowering dogwood.

As the trees have come and gone at irregular intervals, it has not been possible to keep as complete record of individual trees as might have been done in a purely research project. Some of the trees have remained for only three weeks. On the other hand, one red maple and two four-inch American hollies are in their fifth growing season in a pure wood-chip medium.

It has been observed that trees which remained in the stockpile throughout the first or second growing season were in a condition fully as good or better than would be expected of similar trees transplanted for the same length of time in permanent locations.

It is, however, in the root development that the results of using wood chips are remarkable. Much, perhaps most of the success of transplanting is due to this root growth. (It has been relatively easy to see and photograph some of this root growth.) Large trees that normally transplant poorly have made root growth in these chips as abundantly and of as fibrous a nature as that produced by red maples or American elms. This was illustrated clearly by the root response of two four-and-one-half-inch shagbark hickories moved to the stockpile in the fall of 1957. In the fall of 1958, each tree was carrying healthy foliage, had made normal twig growth, and had produced great strands of fibrous roots, three feet or more out from the original ball.

Piles of fresh chips, with or without leaves, heat rapidly for a time even

After it had been in the bins of wood chips for two months, this Crimean linden, *Tilia euchlora*, was lifted in mid-July with a mass of new roots throughout the depth of the ball. Rootlets turn burn in the first-grown older portions; the white brittle tips indicate the actively growing, absorbing portions.

Root growth on a sweet gum, *Liquidambar styraciflua*, which was covered with chips from September 25 to the following May 11, was well started before the leaves developed. The tree prospered in its new permanent location.

without nitrogen and water added. This heat may build up quickly to a degree dangerous to roots and, consequently, to the survival of the tree. If no provision can be made for heat control, fresh chips should not be used in layers deeper than six inches or eight inches, even as a mulch. Where heat control is not feasible, the heat resulting from decay should be allowed to run its course in the unused pile.

Roots of shade trees probably grow best at temperatures of 60° to 80°F. The danger point is reached at 90° to 95°. I feel sure that at soil or chip temperatures of 100° to 125°, roots of most shade trees will die. I have found in a bin of fresh chips leveled off three feet deep, temperatures of 129°, 139°, and even 144°, twelve days after the bin was filled.

Heat may be controlled by making large punchbar holes a foot apart, all the way through the chips, by watering heavily, or by a combination of both. In one large bin which I have under observation (ten months after it was filled), it is necessary to turn the sprinkler on over the bin for twelve to fifteen hours once or twice each week to keep the temperature below 90°. If nitrogen is added to beds which are two to three feet deep, heat increases even more rapidly.

With added nitrogen and water this heating will continue well into the second year. The problem of dangerous heat and its control must therefore be kept in mind. However, this heat, controlled as described, made it possible for trees in the Kent stockpile to produce new root growth during the fall and winter months, well in advance of the time when new leaves would be demanding water and nutrients. Species that are most easily transplanted in large sizes are those that make new roots most rapidly and profusely after the transplanting. This has been true of these stockpile trees.

Roots and what makes them grow have fascinated me during my thirty-seven years with the Davey Tree Expert Co. Consequently, it is intriguing to consider the possibility of manipulating and using the heat latent in chips to keep the soil around transplanted trees warm through the winter, so that the new spring growth may have a fine new root system to support it and to keep it thriving without any lag through the first summer. Tree roots do not remain dormant just because the buds are dormant. I have kept roots growing all winter by wrapping thermostatically controlled hotbed heating wires in the fillback around them.

Fall-set maples in moist, warm, well-aerated wood chips extended new roots eight inches into the fillback in only five weeks. A sweet gum, placed in the bin in September, had sparse but healthy new roots three to four inches long when removed the following May.

Wood chips are too useful for tree men to throw away, and we should more fully inform home gardeners, landscape gardeners, nurserymen, and others about conserving and using this by-product of tree service. We should also encourage research by the plant pathologist, the scientific horticulturist, and the economist on these questions:

Are insects and more particularly fungous diseases transmitted by wood chips? What is the moisture-content, the weight-volume relationship? What, if any, are the chemical and biological differences between chips produced during different seasons of the year? What is the optimum amount to satisfy nitrogen requirements under varying conditions? How do wood chips compare with other products as mulch and soil amendment? What can be done in drying, regrinding, and packaging wood chips to make them more attractive and practical for the home gardener?

MOLECULES (from page 166)

of the particle is the infectious principle, and it probably is intertwined in a cylinder of protein as a spiral coil. It can be removed from the protein which is then non-infectious, but infectivity can be restored by recombining the two bodies.

Other viruses, such as the southern bean mosaic, have an entirely different shape and arrangement of their components. As in tobacco mosaic, the virus consists of protein and a ribonucleic acid. The protein occurs as a shell about 50 Å thick around what has been generally considered to be a spherical body but is more likely an icosahedron. The center of the particle is a ball or

The combed-out root system of a four-inch sugar maple, *Acer saccharum*.

sphere of nucleic acid about 200 Å in diameter. The protein consists of sixty identical units, each with a molecular weight equivalent of approximately eighty-five thousand. Each of these units consist of three strands.

Apparently these nucleoproteins have the capacity to subvert or alter the ordinary biochemical processes of plants. The hereditary mechanism of plants is believed to be carried in the deoxyribonucleic acid (DNA) of the chromosomes. These acids apparently have the capacity to regulate the synthesis of the proteins essential for enzyme systems. It is conceivable that the ribonucleic acids of the virus either interfere with the normal ribonucleic acids of the cell or change the process of the deoxyribonucleic acids. In any event, the physiological processes that are normally regulated by hereditary processes are subverted into abnormal channels to give disease. The symptoms are not due to wasted effort in the abnormal synthesis of virus protein.

The Design of Biologically Active Molecules

Tremendous strides have been made in the last twenty years in the regulation of plant growth by organic molecules synthesized in the laboratory. We know how to stimulate roots, thin flowers, prevent fruit drop, and inhibit sprouting of buds by chemicals. It is possible to destroy selectively one plant but not affect another. In the twenty years since Dr. P. W. Zimmerman and Dr. A. E. Hitchcock discovered the selective hormone activity of 2,4-D, a new industry in selective herbicides has grown and expanded. Closely allied with this upsurge in regulation of plant growth has come an equal revolution in development of fungicides, insecticides, nematocides, soil fumigants.

All these advances in pest control have come through similar channels in exploiting organic chemistry. The general principles behind the design of a molecule for selective activity are very similar in all fields. The molecule must be designed so it will penetrate a living cell and the protective layers over it, move to the site of action, enter into chemical reaction with one or more cell constituents vital to some essential function, avoid entering into extraneous reactions that would detoxify the molecule before it could perform its assigned task, and not present a hazard to the consumer of the produce by leaving harmful residues or toxic reaction products.

The penetration of the waxy cuticle, the cell wall, and the cell membrane that give the protoplast its integrity, calls for a very delicate balance between the hydrophilic and lipophilic properties of the molecule, that is the ability to dissolve in water and in oils or waxes. Usually a relatively long carbon chain or ring structure, such as a parachlorophenyl structure, is added to the molecule to enhance solubility in oil. This is balanced by a polar group, such as a hydroxyl or carboxyl group, that has an affinity for water. With these balanced attributes, the molecule has a chance to penetrate progressively through the cuticularized or waxy outer layers of the cell, the protein layer of the cell membrane, the lipid layer of the cell membrane, and the aqueous medium of the cytoplasm to the site of intense physiological activity—as the enzyme system of the mitochondria.

The molecule must have a chemically reactive group which can become affixed to vital cell metabolites or enzyme systems. This may be the double bond in a quinone fungicide, the carboxyl group in a plant regulant, the nuclear halogen on the cyclic structure of a triazine, or the metal-chelating groups of a hydroxyquinoline. The great difficulty with most organic molecules is that they are too reactive, that is, too prone to react with many cell constituents, which leads to severe waste of the limited amounts of materials that penetrate into the cell cytoplasm. For example, Dr. Lawrence P. Miller and Dr. S.E.A. McCallan have shown, by use of radioactively labeled glyodin and other molecules, that the organic fungicides have tremendous capacity to penetrate fungous spores (up to 6500 p.p.m. in a couple of minutes), but tremendous doses of many compounds (6500 to 20,000 p.p.m. of the spore weight) are required to destroy the spore.

Sometimes the molecules are broken down or detoxified by the cell that they are supposed to destroy. Houseflies that have acquired resistance to DDT have developed a new enzyme. This is a dehydrochlorinase that removes a molecule of hydrochloric acid from each molecule of DDT and renders it innocuous. The DDT molecule can be changed to an analogue that prevents this enzymatic dehydrochlorination. The analogue will kill resistant houseflies until a strain develops another type of resistance.

The metabolism of molecules in the living cells has been exploited to develop secondary products that are safer or more selective as herbicides. For example, if the acetic acid group in the herbicide 2,4-D is replaced with a butyric acid group, the new compound will not injure alfalfa and certain other legumes as does 2,4-D. However, if the alfalfa field has wild mustard growing in it, this very harmful weed will be killed, because it has an enzyme (*b* oxidase) that removes two carbon atoms from the harmless butyric derivative and converts it into 2,4-D. The mustard has, in one sense, committed suicide while the valuable alfalfa does not have this capacity.

The Future Is Promising

When we consider the intricacies that are involved in the regulation of a plant's physiology by a virus — for example, where the regulant multiplies even as it circumvents the hereditary mechanisms — we can see that the chemists have much larger assignments ahead of them. There is no earthly reason why new wonders will not be created in the next thirty years which will completely overshadow the achievements of the past.

As man learns about the behavior of molecules inside the living cell, confidence grows that he can control the living forces to whatever end he desires. The possibilities are limitless, bounded only by the creativity of the human brain. With patience and diligence in unraveling the mystery of the living cell, man should be guided into creating new and useful molecules.

Men and plants have come a long way together through the pages of history. What started out as the collection of a quick meal or the nibbling on a choice fruit during an interlude in the hunt for game has evolved into a full partnership. Neither the society of man nor that of plants can flower into full maturity without the other. The development of a sound understanding of molecules in the life of a plant is the open roadway toward the maturity of this partnership.

REFORESTING THE TENNESSEE VALLEY

By **J. O. Artman**

Mr. Artman has worked with the Tennessee Valley Authority for over twenty-five years and is now Staff Forester in the Director's office, Division of Forestry Relations. He attended the Pennsylvania State Forest School at Mont Alto and was graduated from North Carolina State College School of Forestry in 1931.

The reforestation story begins with the pine cone and its winged seeds. Pictured here are the cones and winged seeds of loblolly pine, *Pinus taeda;* a bushel of these cones yields about three-fourths of a pound of clean seeds. A pound of seeds will produce about seventy-five hundred plantable seedlings which will reforest about seven and a half acres.

THE Tennessee River drains a twenty-six-million-acre valley stretching from the Appalachian Highlands of Virginia, North Carolina, and Georgia, westward across Tennessee, northern Alabama, and Northeast Mississippi to a juncture with the Ohio River in southwest Kentucky. Until DeSoto penetrated the middle portion of the Tennessee Valley about 1540 and for almost two hundred years after, this was the citadel of the Cherokee Nation. French traders, working upstream from the Mississippi, built a few trading posts along the lower reaches of the Tennessee early in the eighteenth century. The British established Fort Loudoun on the river below Knoxville in 1756; and although the Cherokees soon drove them out, it was the British who wound up with control of the Valley after the French and Indian War of 1760.

The main settlement route for this part of the country was out of Virginia, down the north and south forks of Holston River. Other settlers came out of North Carolina, across the mountains and down the Watauga, the Nolichucky, and the French Broad. Knoxville, one of the early settlements, was named the capital of the Territory South of the Ohio in 1791. The Cherokees, outnumbered, outfought, and outvoted, were forced to move west of the Mississippi in 1838. Only a few managed to escape the forced migration, and today the descendents of these few live on the sixty-four-thousand-acre Qualla Reservation in North Carolina, just south of the Great Smoky Mountains National Park.

The Tennessee Valley of the Cherokees was forested for the most part; and what a forest it must have been! Descriptions by the elder Michaux, dating back to 1787, paint vivid pictures of this age-old forest community. The patriarchs included hemlocks seventeen feet around at the base, yellow poplars twenty-six feet in circumference, dogwoods five feet, and shellbark hickories twelve feet. Today we catch just a faint glimmer of this grandeur in the Joyce Kilmer Memorial Forest bordering Little Santeetlah Creek in Graham County, North Carolina, where yellow poplars thirteen feet in circumference tower almost a hundred feet to the first limb.

But this thing of beauty and value from our vantage point was an obstacle to pioneer progress. The forest had to give way to agricultural and industrial development. Half the land in the Valley was eventually cleared, and the cream of the timber crop was skimmed off the other half. Lumber production at its peak about 1909 was almost twice what it is today. Since then the forests have been cut and recut, burned and reburned, and only today is the exploitation trend being reversed.

Despite the fact that fifty-four per cent of the land area of the Valley is still classified as forest land, foresters and agriculturists agree that another one and a half million acres of open land should be reforested. Some of this land is eroding, some is used inefficiently for agricultural crops, and some is idle. On the basis of present-day judgments, it is best suited to timber production.

By comparison, the area reforested in the Valley over the past quarter-century totals 502,300 acres. I do not mean to belittle this progress. Persuading fifty thousand landowners to plant five hundred and twenty-one million seedlings on half a million acres of eroded, idle land is no small accomplishment. But in relation to the total job, and in view of estimated future needs for wood, progress has been discouragingly slow. As in any undertaking, evaluation is a matter of where you stand and the direction in which you look.

First let us look back. When Congress created the Tennessee Valley Authority in mid-1933, the TVA Act made special reference to the glaringly obvious erosion problem. Land had been cropped to death, abandoned, and left to the ravages of nature. Early estimates put the seriously eroding area at something like three million acres, with another seven million acres affected to a lesser degree. In the whole watershed, no more than three thousand acres had been planted to trees. Individual landowners lacked the initiative and know-how to do anything about the gullies that were eating away their real estate.

Since the states at that time had no facilities for mass-producing tree seedlings, TVA established two forest nurseries — one near Clinton in eastern Tennessee and one at Muscle Shoals in northern Alabama. From 1935 to 1942, during the Civilian Conservation Corps era, these two nurseries produced about one hundred and forty-nine million seedlings, and the CCC boys planted them to reclaim 115,300 acres.

Our objective in those early days was to put on public display thousands of small plantations in order to demonstrate that trees would control erosion and put idle land back to work. We made it as easy for the landowner as possible. About all he had to provide was the eroded land and permission for the CCC boys to control gullies and plant trees. As interest grew, he was asked to provide teams and such

These two pictures record eleven years of progress in the Copper Basin, a twenty-five-square-mile area in southeastern Tennessee where copper smelting a hundred years ago destroyed practically all vegetation. The top picture was taken in October 1944; the bottom in November 1955.

materials as fencing and straw for mulching. When the CCC program came to an end in 1942, he had to do his own planting. And beginning in 1957, seedlings were no longer free; he had to pay the going state price.

This gradual stiffening of the program is in itself a good barometer of progress. It was not easy in the early days to persuade landowners to accept this erosion control and tree-planting service, even though it cost them nothing. I recall one incident when there was a mix-up in boundary lines, and the CCC boys planted a couple of acres on the wrong farm. The farmer involved in this unintentional trespass was highly indignant and insisted that every last pine "sprout" be pulled up. Of course, he felt somewhat different eighteen years later while he watched his neighbor thin his planted pines, which by that time contained two hundred dollars worth of pulpwood per acre.

Fifty Thousand Tree Planters

We estimate that some fifty thousand Valley landowners have planted trees. And we believe this means a potential fifty thousand converts to the conservation idea. Planting trees is not a great task; almost anyone can do it. This makes it a valuable first step toward forestry. But more important, it is a powerful mind conditioner that normally leads to other constructive conservation actions.

For example, the man who invests time and money in planting trees usually becomes forest-fire conscious. He has an investment to protect, so he is more careful with fire himself, and he cautions his neighbors to be careful. Planting and tending a plantation of trees also stir interest in other forest land. The landowner who has done little to improve the forty or fifty acres of woodland he already has is prompted to take another look at that land when he plants trees. Then too, there

This area in southwest Virginia, that had been stripped for coal, was put back to work growing shortleaf pine, *Pinus echinata*.

is something deeply satisfying in watching trees reclothe a barren hillside with productive and protective vegetation. It is good for the soul.

But don't misunderstand—all is not altruism and sentimentality. There is an economic side to this tree-planting business, too. And in the last analysis, I suspect it is the economic consideration that really counts.

Here in the Valley the principal species that are being planted are loblolly and shortleaf pine, with some eastern white pine at higher elevations. Growth is such that seven to ten years after planting the trees are big enough to be used for fence posts and ready for a first thinning. In another five to ten years they can be thinned again, and this time the major product is pulpwood. Additional thinnings at about seven-year intervals yield more pulpwood, some poles, and a few sawlogs. At forty to forty-five years from planting, the remaining trees are mature and ready for final harvest.

From measurements on experimental plantings we estimate that an acre of loblolly pine, planted on a good site and managed intensively over a forty-three-year period, will yield seventy-three-hundred cubic feet of wood worth three thousand dollars in the form of posts, pulpwood, poles, and logs. Shortleaf pine, over the same period, can be expected to return seventeen hundred and fifty dollars per acre on a fair site and about fourteen hundred and twenty dollars on a poor site.

If we apply a conservative products-value of fifteen hundred dollars to the half-million acres already planted, it means this brand new resource has a potential raw-material value of about seven hundred and fifty million dollars. And that's not all. To this tangible products-value we can add the intangible, but nonetheless very important, side-benefits of watershed protection, food and shelter for wildlife, and outdoor recreation.

Costs in relation to benefits are almost insignificant. Planting costs, including trees and labor, average about thirteen dollars per acre, and, in most cases, this is the only cost involved. Sometimes one must spend additional money to protect the young trees from fire and livestock, but this is the exception rather than the rule. Land purchase is not usually a factor, and taxes are paid regardless of use or disuse. So a thirteen-dollar investment in an acre of pine will return fifteen hundred dollars and perhaps as much as three thousand dollars over a period of forty to forty-five years, which isn't bad at all.

Earliest Planting

The first record of tree planting in the Valley dates back to about 1890 when Gifford Pinchot was working at Biltmore, George W. Vanderbilt's estate near Asheville, in western North Carolina. Pinchot, just back from the French forestry school at Nancy, was America's first native-born forester, and Vanderbilt was the first American landowner to employ a forester. Pinchot was followed at Biltmore by an imported German forester, Carl A. Schenck. These two men together planted somewhere between one thousand and three thousand acres before 1912, using some forty species of hardwoods and conifers. Their method included both direct seeding and the planting of seedlings, some of which they grew in their own nursery.

The Valley states first became interested in reforestation about 1915. But the few state foresters employed in those days were fully occupied in fighting fire. There was little time or money for anything else. Public interest in tree planting was still dormant. As a matter of fact, a man would have been considered lacking in common sense to have planted trees in an area where fire burned a million acres each year. One or two states had established small nurseries, but total production before 1933 was less than two million seedlings.

In sharp contrast, the seven Valley states in 1959 produced over five hundred million seedlings in state nurseries. Valley landowners planted almost seventy-five million seedlings to reforest 85,270 acres. Over the past five years they have averaged over forty-four million a year, almost three times the average for the 1950-54 period and four and a half times the 1935-39 average.

The big spurt in seedling production by the states occurred about 1956, when Federal funds for nursery expan-

Each year for five years TVA nurseries were systematically combed for superior seedlings — seedlings that were definitely faster growing than the average. This loblolly seedling, only five years from seed, is already twelve feet tall.

NEW — as of September 1, 1960

HUSBAND AND WIFE MEMBERSHIP

$15 a year

Responding to numerous suggestions —
the Garden's Board of Managers has inaugurated this new membership category.

Membership cards will be issued to both husband and wife.

Discounts on tuition fees will apply to both. Both may ride the Floral Flyer without charge. Free parking for either.

* * *

For other membership changes, see article in this issue, page 193

NONE OF THE CHANGES WILL AFFECT EXISTING MEMBERSHIPS UNTIL THE END OF THE PRESENT MEMBERSHIP PERIOD.

ALL Members —

note information on FREE PLANT DISTRIBUTION within this special insert

THE NEW YORK BOTANICAL GARDEN PLANT DISTRIBUTION TO MEMBERS

October 18th and 19th.

The New York Botanical Garden has available for distribution to its members a limited number of small plants of two interesting hardy shrubs. These plants are:

Rosa omiensis pteracantha

(A) *Rosa omiensis pteracantha* is a native of western China. It is a hardy deciduous shrub, at maturity six to ten feet high and as much in diameter. It can be maintained at a smaller size (four to five feet high and about the same in diameter) by judicious pruning. It is of graceful habit, has fine-divided, fern-like foliage and white four-petalled flowers (most wild roses have five-petalled flowers), one to one and a half inches across. The flowers are followed by red, pear-shaped fruits. A most attractive feature of this variety is the very prominent blood-red, transluscent spines that decorate the first-year shoots. In winter these are notably conspicuous, especially when viewed against the sun. For this reason a location where the shrub can be observed under these circumstances is recommended.

Rosa omiensis pteracantha thrives in any ordinary fertile garden soil that is well drained and in full sun. It is pruned by cutting out as many of the old shoots as can be spared, either in spring (this sacrifices flowers but assures the maximum development of young shoots with colorful spines) or immediately after flowering. Propagation is readily effected by cuttings.

Salix humilis

(B) *Salix humilis,* the upland willow or prairie willow, is a native of eastern North America. It forms a broad, spreading, hardy shrub, five to seven feet high, with many tortuous branches which root into the ground. From these horizontal members arise numerous erect branches which bear the flower catkins ("pussies") in early spring before the leaves appear. The plant we offer is staminate (male). Its catkins, which are borne profusely, are predominantly cream-colored with a golden anther tipping each stamen. The grayish green foliage has no outstanding merit. The prairie willow thrives in any ordinary soil in full sun. While it needs no regular pruning, provided it has sufficient space in which to develop, it may be restrained and kept within modest bounds by cutting out old and unwanted shoots immediately after flowering. It is readily propagated by cuttings.

HOW TO GET THEM: Members of the Garden who desire these plants are requested to present the accompanying ticket on *October 18th or 19th between the hours of 10:00 a.m. and 4:30 p.m.* at the Sales Counter in our Main Conservatory Range (the large greenhouses near the Museum Building). As long as the supply lasts, each ticket will entitle its bearer to one specimen of each of the two plants.

Members who cannot call at the times indicated may have the plants shipped to them. Packing and shipping will be done under the direction of our Horticulturist. Even with the best attention in this respect damage sometimes occurs before plants reach their destinations and there is no doubt that it is better for members to arrange to pick up the plants at the Garden if they can do so. Orders to be mailed will be sent as soon as convenient, which may be before or after October 18th and 19th.

The number of the above plants available for distribution is limited and it may not be possible to fill all requests. The New York Botanical Garden does not recommend shipping plants outside the Japanese Beetle Quarantine Zone.

If you cannot come and wish to have the plants mailed, sign and return the ticket promptly, together with one dollar and the accompanying shipping label (please write the name and address to which you wish the plants to be shipped on this). Address requests to Plant Distribution, The New York Botanical Garden, Bronx Park, New York 58, New York.

SHIPPING LABEL

See other side for ticket

Cut on this line

From
The New York Botanical Garden
Bronx Park, New York 58, N. Y.

CONTENTS: Merchandise. Package may be opened for inspection.

For

Name .....
(Please Print)

Street Address .....

City .....Zone No. ..... State .....

Cut on this line

THE NEW YORK BOTANICAL GARDEN

Ticket for Plant Distribution - October 18th and 19th, 1960

The presentation of this ticket properly signed at the Sales Counter in the Main Conservatory between 10:00 a.m. and 4:30 p.m. on either of the above dates entitles the bearer to one specimen of each of the two plants being distributed as long as the supply lasts.

Signature of Member .....

Address .....

PLEASE BE SURE TO SIGN AND BRING OR SEND THIS TICKET WHEN APPLYING FOR THESE PLANTS

sion became available through the Soil Bank program. Before that time practically all of the seedlings planted in the Valley came from TVA's two nurseries. Now well over half come from state nurseries; and because state production is catching up with demand, our Muscle Shoals nursery was closed this year.

Cooperative Effort

Reforestation in the Tennessee Valley is a function of the state forestry agencies, just as it is elsewhere in the country. Within each of the seven Valley states, the state forester is the project leader. TVA's role is one of cooperating, coordinating, integrating, and supplementing. We have done much of the required investigation in cooperation with the United States Forest Service experiment stations. Our one nursery still in operation helps state nurseries meet the demand for seedlings and at the same time serves as a pilot plant for developing and testing new nursery techniques. Our foresters are taking an active part in improving planting stock, developing the art of pine grafting, searching out specimens of superior pines, and establishing orchards of grafted pine for the production of high-quality seed. We have recently begun a comprehensive study of fertilizers as they may apply to tree planting and the other forestry activities. And here we are backed up by TVA chemical engineers and agriculturists with their vast experience in fertilizer research and development.

The agricultural extension divisions of the land-grant colleges have also been active participants in reforestation. County agents have been largely responsible for selling the tree-planting idea to farmers and helping them decide which lands to plant. They have encouraged civic groups and banks to purchase tree-planting machines and

(Continued on page 191)

Top. Farmers in Henderson County, Tennessee, take time to learn how to control erosion and plant trees.

Center. Students of a vocational class in agriculture at a Virginia high school learn how to plant trees and at the same time install a backdrop for a new recreation field.

Bottom. Clinton Nursery is a favorite with touring school groups. Here a group listens attentively while the nursery superintendent explains how seedlings are produced.

ECHOES OF THE PAST

The New York Botanical Garden and Bedford Chapter 882 of the Agassiz Association

IN DISPOSING of the home occupied for a number of years by Miss Eloise Payne Luquer and her brother, for the executors of the Luquer Estate, William Kemble of Bedford, New York, was able to salvage a few articles from the library. One of these was the minutes book of the Bedford Chapter 882 of the Agassiz Association. In looking over its yellowed pages, Mr. Kemble noticed the report of a field meeting of the Torry Botanical Club held at Bronx Park on October 19, 1895.

The report was in Miss Luquer's handwriting. She was then the Chapter's Secretary and deeply interested in botany and conservation. She made the first nature trail for the Bedford Garden Club in the Ward Pound Ridge Reservation — in fact, she is credited with having been the originator of nature trails. The Garden Club of America presented its Conservation Medal to her and in 1950 established the Eloise Payne Luquer Medal in her memory. It was awarded in 1957 to Dr. William Jacob Robbins, then Director of The New York Botanical Garden, for medical research in botany.

Mrs. Edwin De T. Bechtel, another friend of The New York Botanical Garden, read Miss Luquer's report of the field meeting and suggested making it available to the Editor of *The Garden Journal.*

Mr. Kemble, however, did more than this — he entrusted the precious minutes book to the Editor since he found, on further reading, a number of references in it to the Garden. These are reproduced below.

Eight people, including the Rev. and Mrs. Lea Luquer and their daughter Eloise Payne, met on July 1, 1887, to organize a chapter of the Agassiz Association. They agreed to meet at the residence of Brenton Boggs, who was elected secretary, every other week (later changed to once a month). The first meeting was held at his home on July 6, 1887, when the charter of the new chapter was received from Prof. Harlan H. Ballard, President of the Agassiz Association.

Two years later, when Mr. Boggs moved from Bedford, Mrs. Luquer replaced him as secretary, and until her death in 1894 was one of the leading members of this small group of naturalists, "taking constant pleasure in the study of the beautiful things of nature." Her daughter Eloise Payne later held the office of secretary.

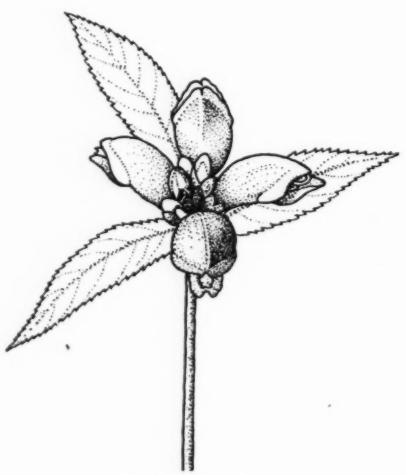
Papers on botanical, entomological, geological, and mineralogical topics were prepared for presentation at the meetings, and articles within these areas were read from such magazines as *Popular Science Monthly, Science News, Harper's Weekly, The Circle of the Sciences* (English), *Garden and Forest, Atlantic Monthly, American Naturalist, London Saturday Review.* "Lessons" were taken in botany, including plant identification, and entomology. The members of the chapter were especially interested in the Compositae, trees, ferns, mosses, lichens, and fungi. Wildflowers, mosses, fungi, insects, minerals, woods, shells, and seaweeds were exhibited at the meetings, and a collection cabinet was acquired to accommodate permanent displays.

August 17, 1887. "... Miss Luquer exhibited 25 specimens of fungi gathered in the parsonage woods, also a collection of wildflowers. . . ."

September 14, 1887. "Miss Keeler exhibited *Chelone glabra* (turtlehead) and *Spiranthes gracilis* (ladies' tresses) and other wildflowers. Mrs. Boggs exhibited fossil shells found in Beaver dam brook. . . ."

April 7, 1890. "... Dogtooth violets were shown by Miss Luquer. They were picked on April 6 along the Rectory brook. . . ."

February 13, 1891. "... Miss Bates added several specimens of wood to the collection now embracing about 60 pieces which were examined with interest. . . . Miss Luquer's collection of wildflowers of this township was examined. . . ."



Chelone glabra.

April 3, 1891. "... Mrs. Eastman brought a little bunch of trailing arbutus budded at Easter. . . ."

July 11, 1891. "A field meeting in the woods opposite Mr. [Gustavus] Kirby's house. Seed pods of many spring flowers were collected, particularly of a trillium and smilacena. Great quantities of *Pyrola* [*elliptica*] were found."

From the annual report of the Secretary of Chapter 882 to Prof. Harlan H. Ballard, dated November 10, 1891. "Our herbarium contains 120 specimens, besides grasses (30) and ferns (8) . . . we have secured 50 specimens from trees growing in our immediate neighborhood, which we have had to cut to show the bark and horizontal, vertical, and transverse sections of the trees. On one of our field meetings, the Society made itself very familiar with the foliage of these trees and, under skilled guidance, with the manner of growth of branches and leaves. ..."

July 22, 1892. "The members . . . went for a walk and under the guidance of Mr. Bates explored a part of Old Pitch Swamp. The swamp being quite dry it was possible to penetrate a good way into it, and it was most interesting and beautiful. Several new species of ferns were found, and good specimens of *Habenaria psycodes* and *H. virescens,* two kinds of mountain mint, and of scutellaria. We admired the tall ferns — in places as high as our heads — and the sweet swamp azalea which was abundant in one part, and we formed an intimate acquaintance with nettles and catbriars." D. W. Marble, Secy. pro tem.

"Spring of 1893. The party under the guidance of Mr. Bates drove to Middle Patent, and from there walked through River Hills to the beautiful waterfall which was very full. Many interesting flowers — thick beds of violets, both blue and white, and large quantities of purple trillium being especially striking."

May 28, 1895. "The members met at Mr. Bates' and drove to Middle Patent, and from there walked to the beautiful waterfall in River Hills, and clambered down the rocks to the foot

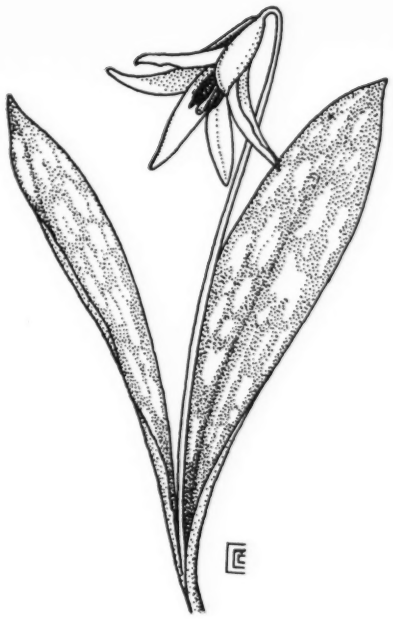
of the cascade, where it joins the Mianus River. Many interesting flowers were found, including a cypripedium, wild ginger, medeola, [and] broom rape. Mr. Luquer suggested that a name be given the waterfall . . . and it is now 'Moss Cascade'; a most appropriate name as the rocks over which the stream tumbles are covered with exquisitely green soft moss, making a beautiful contrast with the foaming white of the little cataract. . . ."

"On Saturday, October 19 [1893], Miss [Cassie M.] Bates, Miss Lena Wood, Miss Marion Wood and Miss D[elia] W. Marble joined the field meeting of the Torrey Botanical Club held at Bronx Park, with Prof. N. L. Britton as guide. The object of the meeting was to see the new Botanical Gardens, where work has just been begun.

"The party started from the Bedford Park station and conducted by Prof. Britton walked through that part of Bronx Park which has been reserved for the New York Botanical Gardens, [sic] an area three quarters of a mile long and half a mile wide, very diversified in character, containing a beautiful hemlock grove 40 acres in extent, a fertile open glade where the first furrows were being turned for the future nurseries, a tract of flat 'gravel bottom' near the river where it is proposed to lay out the systematic garden, and a 'flood level' of silt still nearer the river with swamps where aquatic plants can be cultivated.

"A large part of the garden is covered with fine woods, where some of the finest trees had already been marked with the labels of the Botanical Gardens.

"The old Lorillard House is in the midst of the Garden, although it is retained by the Bronx Park, not being needed for any purpose of the Garden. It is owing to the estate having always been in the hands of the Lorillard family that the trees, etc., are so perfectly preserved. The Bronx River, with a pretty waterfall, is a most attractive feature of the place. Two fine pot holes were pointed out, as well as numerous noteworthy trees, both native and cultivated. A fine specimen of [name omitted] was found, being native there, though never seen here by us, and *Aster tradescantii* was kindly identified for us by Prof. Britton, to our great enlightenment. Both Prof. & Mrs. Britton showed themselves most kind and ready to answer any questions, and the afternoon was instructive as well as delightful to us."



Erythronium americanum.

From the annual report sent to Prof. Harlan H. Ballard, November 17, 1896: "Last winter we began the study of mineralogy, using as a text book Prof. Dana's *Outlines of Mineralogy*. An instructive and entertaining lecture on some of the simpler methods of determining minerals was given to us by Ira McI. Luquer, Asst. Prof. of Mineralogy in Columbia College. We held a field trip to explore quarries near us, where feldspar and quartz are quarried for manufacture into porcelain. Good specimens of rose quartz, red and white feldspar, and mica were obtained; also oxide of manganese and tourmaline crystals. In the spring we took up again Prof. Wright's course on trees, using fresh specimens as far as possible for analysis study. The course on *Compositae* we finished during the winter. . . ."

March 23, 1897. ". . . The last half of the meeting was devoted to a study of the mosses, with the help of Mrs. Britton's articles in *The Observer*, the specimens, and such help as could be gathered from the plates in Gray's Manual and Prof. Sargent's book on Cryptogams. . . ."

May 19, 1897. "The party assembled at Mr. Bates' and drove to Middle Patent, and from there walked through the lane and wood path to River Hills waterfall. The path was carpeted with violets, among which *V. palmata* was abundant. The azalea was in bloom, and the woods . . . full of young ferns with half-coiled fronds. . . . With Mrs. Britton's help, thirty different species of mosses were collected which Mrs. Britton most kindly sorted and named for the chapter on the following evening. . . ."

May 20, 1897. "Mrs. N. L. Britton most kindly gave a lecture on mosses . . . called 'A Climb Up Whiteface,' . . . and was a delightful account of a day's tramp up this famous mountain with descriptions of the many mosses collected on the route. The lecture was illustrated by lantern slides showing enlarged drawings and sections of many species of mosses, interspersed with charming views of Lake Placid and Whiteface. After the lecture the audience examined the large collection of mounted specimens of Adirondack mosses which Mrs. Britton had sent, being part of the Columbia University Herbarium. . . ."

"No meetings were held in 1902."

"Several meetings were held in 1903."

"During 1904, 1905, and 1906 meetings were held at irregular intervals. But it should be recorded that this Society has competed for the prize offered by The New York Botanical Garden for the best collection of wild-flowers at the exhibitions of the Horticultural Society of New York [and The New York Botanical Garden], held in Bronx Park in May and June of each year. The Bedford Agassiz won first prize [entry cards marked first prize are attached to the minutes book] in the May exhibit several times, the only exceptions being once when first prize was carried off by young collectors at The Botanical Garden and two years when we were unable to send exhibits. We won first prize at the June exhibition each time we were able to compete; one year took second prize for collection of native ferns, first prize going to Siebrecht & Co. . . . Two years children helped collect [wildflowers] and a number of them went to the Botanical Garden and helped to arrange the exhibits. The exhibits won prizes as much by the care with which they were arranged as by the number and variety of specimens shown."

July 14, 1909. "... It was decided to make a collection of the local flora of Bedford. The old collection begun in 1888 and '89 was examined and found to be in good condition. Miss Bates' fern collection was found to be in excellent condition. ..."

"Through the interest of Dr. N. L. Britton, The New York Botanical Garden undertook to furnish the necessary outfit of mounting and drying papers for the collections in consideration of receiving duplicate specimens of any rare or interesting varieties for their local Flora. . . ."

1910 . . . Miss Luquer kindly consented to allow the Society to give an exhibition of her pictures of wildflowers in the Court House. . . . Mrs. Britton gave a talk on the wildflowers. The Court House was full, both children and townspeople being present. . . ."

"Large additions to the collections were made during the year."

1911. "In June, Miss Luquer gave for the Society and for the school children a talk by Nina J. Marshall on flowers and insects illustrated by large models. It was greatly enjoyed. The New York Botanical Garden gave further donation of mounting paper."

1912. "In the early spring of this year a meeting of the Society was held at the Women's Cosmopolitan Club in New York to consider a plan . . . for using the Old Stone School House for a museum of local historical and local natural history collections. The idea met with general approval." (The plan was referred to the School Commissioner and Trustee of the School District and met with their approval).

"On July 6, Mrs. James S. Day and Mrs. Lathrop Colgate went to Mrs. O'Brien's residence and formally took possession of the School House for the purpose mentioned above. . . .

"The sum of $500 was given as an endowment fund in memory of Mrs. Lea Luquer, the founder of the Bedford Agassiz Association."

June 23, 1916. "... Miss Marble and Miss Luquer, a committee to plan for the correct and legal method of handing over the lease of the Museum and its funds to the Bedford Historical Society. . . ."

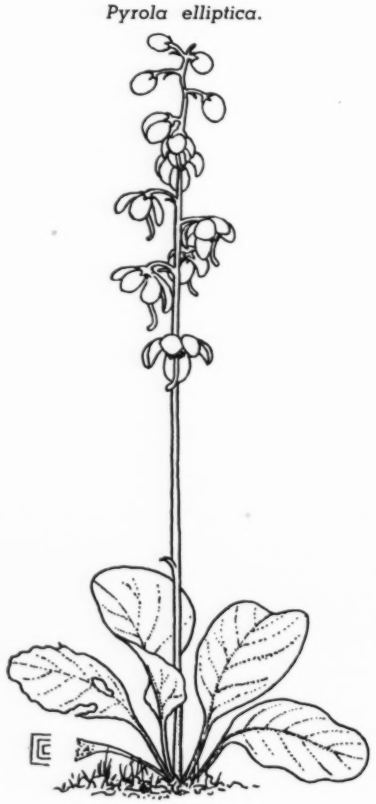
December 1, 1916. "... Miss Marble and Miss Luquer reported having consulted Mr. Spafford concerning the transfer of lease of Museum Building and funds to the Bedford Historical Society. Mr. Spafford informed them that the transfer could readily be arranged. . . . It was resolved, on motion of Miss Luquer, seconded by Miss Colgate, that the Agassiz Society should transfer the lease of the Museum Building and the two memorial funds, each of $500 given by Miss Luquer and Mrs. Maddock, on the proviso that the income of the memorial funds be used for the support and upkeep of the Museum. . . ."

From a letter dated March 1, 1917, from Thatcher T. P. Luquer, President of the Bedford Historical Society, to Mrs. Emily H. Spafford, Secretary of the Bedford Agassiz Society: "At a meeting of the Directors of the Bedford Historical Society, the offer of the Bedford Agassiz Society . . . was formally accepted with thanks, with appreciation of the spirit in which the transfer is made, and in accordance with the conditions mentioned."

HOUSEWIFE'S GARDEN (from page 177)

ish white flowers are too small to be considered photogenic, unless the picture can be magnified several times. When a television studio in Chicago phoned to ask where they could find

Pyrola elliptica.



a dozen or more coriander plants in bloom in June, I was struck with the way in which herbs have come to the fore. One of the large meat-packing concerns wished to show the herb, with which its product is flavored, in a television commercial.

I had a dozen plants of coriander in flower but did not invite the television cameraman, who would "go anywhere in the country to film them," to come here. They were growing in a scattered group where the seeds had fallen. No amount of trick photography would make the very slight, two-foot tall plants resemble a field row planted for harvesting. Then, too, I could imagine the repugnance with which someone not enthusiastic about herbs would encounter this herb. The scent of squashed bugs which is released upon disturbing the foliage of coriander is not to most people's liking. So marked is the odor that the ancient Greeks named the herb 'koris" meaning bug, and Gerard, the English herbalist, said in 1597, "it is a very stinking herbe."

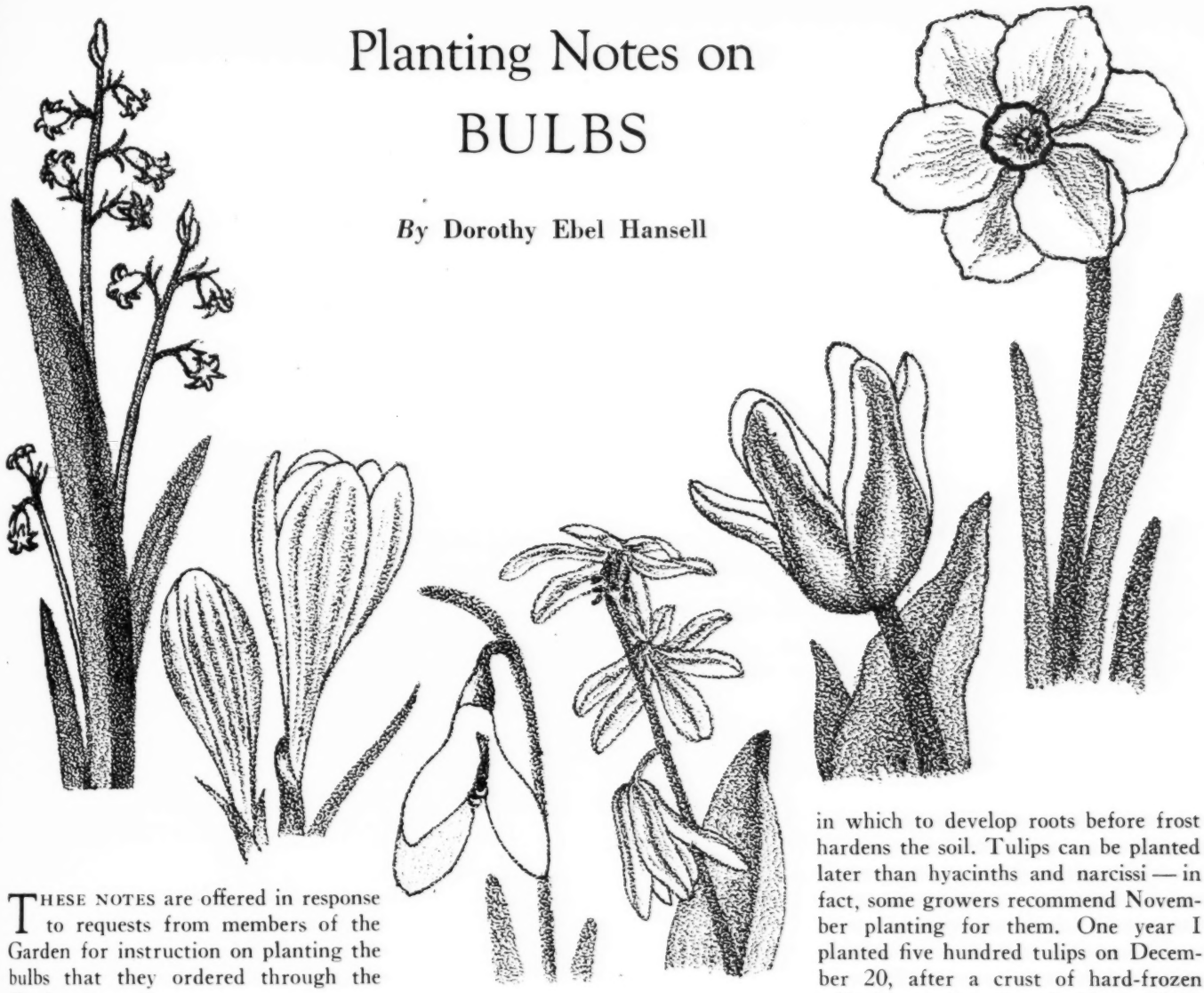
Each year thousands of pounds of coriander seed and oil are imported into this country for the drug and food trades. The green herb is grown in quantity in India, China, South America, and Central America for flavoring soup and for use in salad. In Spanish it is called "cilantro," and it is so labelled in Mexican markets. Coriander is rich in vitamin C, and the dried fruits yield important amino acids. It is a hardy annual herb, matures in sixty to ninety days, and can be grown in all parts of this country, yet few gardeners recognize it in seed or in leaf.

The lower leaves of coriander resemble those of anise, being rounded with toothed edges. The upper leaves are linear, becoming more and more inconspicuous as the delicate flowers give way to seeds which seem top-heavy on the slender stems. The seeds, properly known as fruits, are almost perfect spheres, an eighth of an inch in diameter. When dried they split apart into halves which enclose a single kernel or seed in each. In India where coriander is a large crop, the seeds are rubbed by hand to distribute the hemispheres when planting. In my garden some of the fruits are scattered over the place where the ripe plants have been pulled, and next year's crop is

(Continued on page 190)

Planting Notes on BULBS

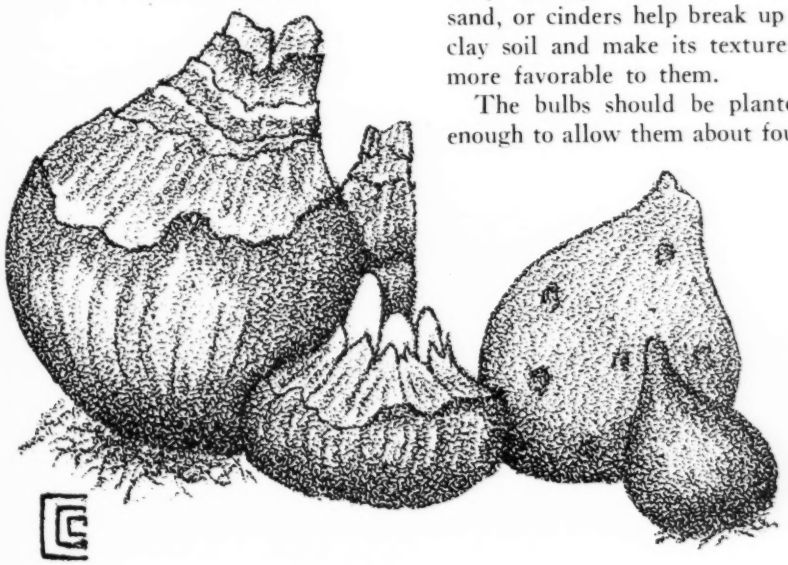
By **Dorothy Ebel Hansell**



THESE NOTES are offered in response to requests from members of the Garden for instruction on planting the bulbs that they ordered through the Garden.

Tulips, narcissi, hyacinths, crocus, and the "minor" bulbs are planted in the fall in well-drained garden soil—a fertile loam. Drainage is important. These bulbs dislike a wet soil, particularly during dormancy. Peat moss, sand, or cinders help break up a heavy clay soil and make its texture lighter, more favorable to them.

The bulbs should be planted early enough to allow them about four weeks in which to develop roots before frost hardens the soil. Tulips can be planted later than hyacinths and narcissi — in fact, some growers recommend November planting for them. One year I planted five hundred tulips on December 20, after a crust of hard-frozen soil, three inches deep, had been lifted. The display of superb blooms on stalwart stems the following May was magnificent. I am not suggesting that this very late planting be practiced — it was a cold and uncomfortable task,



though most rewarding—but cite the incident to indicate that late planting can be done if circumstances demand.

After the soil has frozen to a depth of two or three inches, a winter covering of evergreen branches, salt hay, or leaves other than maple may be provided to prevent the damage or loss that sometimes occurs from alternate freezing and thawing.

In preparing the soil for planting bulbs it should be dug to a depth of ten to twelve inches, and leafmold, peat moss, or humus should be thoroughly incorporated. In the upper six or eight inches in which the bulbs are to be planted, bonemeal or a complete fertilizer (5-10-5 analysis) should be added. The soil is leveled at the planting depth recommended for the particular kind of bulb. The bulbs are planted, pointed end up, at the proper distance apart and then covered with good topsoil. Another way is to prepare, to the proper planting depth, an individual hole for each bulb. This is an easier method for planting a few bulbs in front of shrubs or in a mixed border, but the former method gives a more uniform appearance when one is planting beds of bulbs in larger quantities.

Tulips are planted five to six inches apart and five to eight inches deep. The deeper planting is necessary if the bulbs are to be left in the ground and not lifted, sorted, and stored during the summer for fall replanting. Tulips prefer a sunny location, though they will tolerate very light shade.

Narcissi are planted six to eight inches apart and five to six inches deep, except the species and some varieties. These are planted three inches deep and three to four inches apart. Narcissi are left undisturbed in the ground until they produce poorer and fewer blooms. Then, after the foliage has died, they should be lifted, separated, and replanted.

Hyacinths are planted six to eight inches deep and the same distance apart. They require sun and give a more satisfactory performance if lifted and stored during the summer for fall replanting, though some gardeners do leave them in the ground for several years with good results.

Crocus are planted three inches deep and three to four inches apart in sun or in light shade. It is essential that their foliage be allowed to die down completely — it must not be cut off before it is fully ripened. This creates a problem if crocus are planted in a lawn; it is advisable to reorder and replant crocus bulbs every fall.

Chionodoxas, eranthis, galanthus, muscari, and scillas are generally referred to as the "minor" bulbs. The planting depth, from the top of the bulb to the surface of the soil, for chionodoxas and galanthus is three inches; for eranthis, muscari, and *Scilla sibirica,* two inches; for *Scilla campanulata,* four inches. *S. campanulata* is taller and more robust-looking than *S. sibirica.* The latter is pretty among rocks, in clumps in front of shrubs, or in the foreground of a mixed border. The former is useful for naturalizing in open woods.

On the whole, the minor bulbs are most happily planted in and around rock crevices, on sloping ground, or in a slightly raised bed, so that they get the drainage they need and so that their flowers, borne on comparatively short stems, are not so likely to become mud-spattered during heavy spring rains.

These minor bulbs are not lifted and stored, but are allowed to remain and multiply where planted. If they should become overcrowded and their blooms lessen, then it would be time to lift, sort, and replant immediately, or to store them for fall planting.

Mice, squirrels, and chipmunks find crocus especially tasty, and rabbits relish the tender young foliage. They do not appear to bother the minor bulbs.

HOUSEWIFE'S GARDEN (from page 188)

assured. Coriander will reward you with pretty little blossoms and pleasantly spicy fruits year after year though you, with Gerard, may say "I never sowed the same but once."

Few people are indifferent to this herb. Twenty years ago when it was never mentioned outside of the spice trade or books about herbs, Rosetta Clarkson praised the seeds as wonders of nature's design. She grew a good deal of coriander and incorporated the dried fruits in her famous pot-pourri mixtures. Helen Fox, author of *The Years in My Herb Garden* and two other books on herbs which helped to bring the little-known aromatics to the popularity they enjoy today, warned herb gardeners not to mistake the leaves of coriander for those of anise, since the former taste so unpleasant.

Dioscorides, Greek herbalist of the first century, praised it and at the same time cautioned his readers against coriander. The seeds, on being "drank," expelled worms, and "it is engendering of seed. But being taken too much it disturbs ye understanding dangerously, whence men ought to avoid the overmuch, & too much use of it." No wonder coriander appears as an aphrodisiac in a *Thousand and One Nights.* Gerard and other English herbalists felt that the seeds could be dangerous—today we know that an excess can produce narcotic effects. Still they advised coriander for promoting digestion and for preserving meats. In the former use they were often sugar-coated to form round balls, sometimes colored pink, called "comfits." Such pellets can be still bought on paper tapes, but unfortunately the spicy seeds of anise, coriander, or caraway, which might have given the candy some character or value, are missing in the centers.

Culpeper who loved to wade into any controversy seems to have ignored coriander in his herbal. At least I could find no mention of it in several reprint editions of the *English Physician,* known as *Culpeper's Complete Herbal* in modern times. Gerard declared the green herb "unwholesome and hurtfull to the bodie." He even mistrusted the ripe seeds unless they were dried, soaked in wine or vinegar, and dried again before they were used. He suggested that:

"No Apothecarie ought to sell the seeds of Coriander to any person, except it be first prepared in manner above said, neither ought they to put the same in medicine: for although the seed well dried be of good taste, yet it is not altogether voide of some of that filthie and venemous quality which remaineth in the greene herbe . . ."

Coriander has belonged to many civilizations. Seeds were found in the Egyptian tombs. The Israelites described manna as being like coriander. Meat was preserved with the seed of coriander and sprinklings of vinegar in ancient Rome. Chinese emperors sent out parties to collect plants and considered *Coriandrum* a prize find. Coffee served with kernels of coriander fruits crushed in the bottom of the cup is a treat for visitors in India even today.

From the In. ian Embassy I learned that this important ingredient of curry powder is grown in all states of that country as well as in Asia Minor, Russia, central Europe, and Morocco. The entire plant, when young, is used in India in preparing chutneys and sauces, curries and soups. The ripe fruits are extensively employed as condiment in making curry powder, pickling spices, sausages, and mixed seasonings. They are used for flavoring pastry, cookies, buns, and cakes, and tobacco products. In the United States and in Europe the oil is added to gin and other liquors. This is another contradiction, for the herbalists reported that coriander reduced the intoxicating effect of spirituous liquors. The fruits are considered soothing, antibilious, cooling, and aphrodisiac. They are used to correct the griping qualities of rhubarb and senna. The seeds will remove unpleasant breath when chewed. Quite a useful herb even if it never appeared on television.

REFORESTING (from page 185)

make them available to farmers. Through 4-H Clubs and other farm youth groups, they have helped train a new generation of tree planters. State agricultural experiment stations have had a hand in testing improved varieties of nut trees and pines from a wide range of seed sources.

Two other Federal-aid programs have also influenced tree planting in the Tennessee Valley: the Agricultural Stabilization and Conservation program and the Soil Bank program, both administered by the United States Department of Agriculture. The former, an extension of the Agricultural Adjustment Administration Act of 1933, provides payments to farmers to help defray tree-planting costs; the latter offers financial assistance in the conversion of crop land to long-term conservation use, plus annual rental payments on such lands. Through 1958, landowners in the one hundred and twenty-five Tennessee Valley counties had received ASC payments exceeding $511,000 for reforesting over 63,500 acres. By the same date, close to one hundred thousand acres had been put in the Conservation Reserve of the Soil Bank under contracts that will net landowners over two and a half millions. However, less than ten per cent of this Conservation Reserve was planted to trees.

TVA has invested over eight hundred million dollars in dams, locks, and hydroelectric facilities. Our primary tree-planting objective is to protect this investment against the damaging effects of erosion and silting. However, as we reach this objective through reforestation and better forest protection, management, and utilization, we also improve the economic value of the resource. Industrial forest-product values, now estimated at four hundred and fifty million dollars a year, can be increased to eleven hundred millions. Jobs in forest products industries can be increased from the present fifty thousand to two hundred thousand.

If the planting rate can be maintained at eight million seedlings a year, the reforestation job in the Tennessee Valley can be completed in the next fifteen years. The cost is estimated at thirty million dollars — two million a year — shared about equally by cooperating public agencies and the landowners who do the planting.

Over a half-century or less we can expect to harvest from these hand-planted forests seven hundred and fifty million fence posts, twelve million cords of pulpwood, and twenty-seven billion board feet of poles and logs. At present prices these primary products would be worth more than two billion and two hundred million dollars. In terms of pulp and paper, treated poles and piling, finished lumber and other millwork, values would be well in excess of five billion dollars.

Wood requirements in this country are expected to increase at least fifty per cent by the end of the century. We cannot wait till then to provide these needs; we have to start now. Richard E. McArdle, Chief of the United States Forest Service, said recently that the sixties will be the "decade of decision" for the American timber industry. He predicts that old-growth timber, which now supplies about one-third of the national needs, will be practically gone by the year 2000. Our inheritance will have been used up. Here in the Tennessee Valley, where old-growth timber ran out years ago, we are well on the way toward ensuring a continuous supply of timber for industry and a protective cover for the watershed of America's fourth largest river.

THE BED O'PATTIKEWS

From *Moby Lane* by A. Neil Lyons, published in London, 1916, by The Bodley Head Ltd. (founded in 1892 by John Lane).

Dr. H. W. Rickett, Bibliographer and Acting Assistant Director (Botany) of The New York Botanical Garden, has a copy of *Moby Lane* in his library. He suggested to the Editor that readers of *The Garden Journal* might enjoy the chapter on "The Bed O'Pattikews."

GIDEON HEMUS used to live in Sloe Cottage, which stands at Sly Corner, near the crossroads, behind the blacksmith's, not far from Blowfield, in Sussex.

I first became intimate with Mr. Hemus in connection with certain mercenary transactions. I had been conducting barter with Ellen Mary Hemus, Gideon's wife, in the matter of Campine cockerels. When Mrs. Hemus came out with the change to their cottage gate, she uttered the following strange speech:

"Hemus send his respects, sir, and will you please to walk inside. If it isn't taking a liberty, he would like you to look at his pattikews."

"But I am not a doctor," objected your servant.

Mrs. Hemus regarded me with an expression of surprise.

"Cert'nly not, sir," she answered. "You be a gentleman. We know that."

"Isn't it a disease, then?"

"Sir?" queried Mrs. Hemus.

"This—ah—patticuse. It has a pathological sound."

"Cert'nly *not,* sir," replied Mrs. Hemus, with spirit. "I woon't *hear* of such a thing, that I woon't. Anybody's welcome to come into my house, that they be, and look for theirself."

I made apologetic noises. Mrs. Hemus reciprocated. She opened the gate, and I followed her into their little front garden. Mr. Hemus, extruding his head from an attic window, proclaimed that he was mending his trousers, but that in half a minute he would have completed that act of decency and could then join me. He requested me to be so good as to wait. I accordingly waited: and Boreas did blow.

When Mr. Hemus eventually descended—the process of rehabilitation had occupied much more than half a minute—a suspicion which had been gradually forming in my mind was confirmed. The pattacuse—or pattikews,

as I soon learned, under Mr. Hemus's direction, to call them—belonged to the race of vegetables. A horticultural work of reference, which I have since consulted, insists upon calling them hepatica. It says that this is a well-known name applied to a section of the anemone family, Order *Ranunculaceae*.

The pattikews, when I first beheld them, were clothed in their mid-winter *deshabille*. Mr. Hemus pointed to a vast bed of low-growing foliage, which occupied the best part of his front garden. A novice, such as I was, might have mistaken the plants for ground ivy, as I did—ground ivy which had succumbed to an attack of jaundice. Mr. Hemus stroking the leaves with his gritty blue fingers, invited me to do homage to them. I wondered (having at that moment no opportunity of consulting a horticultural work of reference) whether they constituted a salad.

"Did ever you see such pattikews as they be?" demanded Mr. Hemus.

I admitted that I never did.

"He have grown them," said the voice of Mrs. Hemus, in tones of soft affection, "according to a patent of his own. They areun't been allowed to flower this three yeer past, that they areun't. Oold Amos Pranklyn, the hedger—him over at Franklands—*he* rackon to grow pattikew. But . . ."

Mrs. Hemus finished her sentence with a derisive laugh.

"Amos," stated Gideon, "will find out what a pattikew really look like, come Easter. 'Tis no manner o' use to leave 'em bloom, not until the roots be got a-holt. So I are tal oold Amos; but th' oold beggar, he be that stubborn, he don't never listen to what anybody tal him. A pattikew that want two year, it do, to get a proper holt with its root. And even then, if a person rackon for to grow blooms as *he* blooms, he got to nip off the buds in the third year. Well, we'll see about it at Easter time. Oold Amos'll find out what a pattikew really look like, come Easter, shouldn't wonder."

"You see, sir," explained Mrs. Hemus, "he have growed them according to a patent of his own."

II

When I next heard of the pattikews, I heard a tragic thing. They had been trodden on. The treading was performed by a stag, three boys, a dozen men,

A nosegay of hepaticas.

half a dozen horses, and eight couple of hounds.

It seems that the staghounds had been invited by Squire Kosky to breakfast and other hospitalities, including the right of entry to Mr. Hemus's garden. Squire Kosky himself does not hunt stags, that pursuit being an active, very noisy and slightly dangerous one. But he does eat breakfast, and well he can afford to do so, being the Head and Brain of Kosky and Leverson, the Imperial mathematicians.

They brought the stag in a sort of windowless hearse, and, after they had breakfasted with Kosky, they opened the hearse and the stag jumped out and ran away.

After the stag (which, by the way, was a hind) had been allowed to run for a certain number of minutes, as recorded by the watch of a stout gentleman on a stout horse, who, at stated intervals, uttered the words: "Hounds, ladies and gentlemen, please!" they all ran after it and found it, after a brief search, in Gideon Hemus's garden, where it and the hounds and the horsemen and a detachment of peasantry and several highly illuminated servants with whips did not do much good to the bed of pattikews.

I found, on offering my condolences to Gideon, that the husbandman treated the matter with admirable philosophy.

"'Tis a pity in one way," he confessed, "for they was fit to bloom, come another fortnight. But 'tis of no consequence in the main; for I can easy nip their buds off, to set them back again, and mulch 'em. The blooms'll be something to look at *next* year. You can't keep a pattikew back too long. The secret of growin' pattikew, that be to let their roots get a firm holt of the soil. I shouldn't wonder but what oold Amos Pranklyn find out what a pattikew look like, come the Easter arter next."

[However, the pattikews were not to bloom the "Easter arter next." Gideon was forced, by unfeeling powers, to move to another cottage, situated in an old excavation known as "The Hole."]

V

I then asked him who had been barking the fruit trees at Sloe Cottage. He re-opened his clasp-knife and jabbed again at the stile.

"Have they been spoilin' they fruit trees, then?" he asked, with averted eyes. "They fruit trees was planted be moi oold father. 'Tis a pity if anybody are damaged them. The boys and young lads, they be ser saucy and mischievous nowadays. Moi father, *he* planted they trees—all exceptin' the quince tree, and that weer put in be moi gran'father. 'Tis a pity if anybody are damaged them. Hey? Well, I'll be gettin' on." He lifted the basket of clay and leaves to his shoulder.

"These," he said, with a sideways jerk of his head, "'ull 'ave to put up with it, same as me, I spoose. Their roots'll have time to get a hold before the spring come, I shouldn't wonder. They'll 'ave to go through with it now, whather or no. Oold Amos 'e'll git the laugh of me, if I don't show a bloom *next* spring."

But there was a further delay in the production of those remarkable flowers. On a night in January, there came one to my cottage who asked for a ladder. He said that the house in "The Hole" was burning, and that Gideon wanted to rescue his potatoes from the loft.

I returned with this man to the house in "The Hole," which, I found, was burning well and brightly. Squire Kosky, with whom were the Misses Kosky, wearing theatre wraps, was present, and directed the salvage operations with much spirit and gesticulation. No fire engine had arrived, because the fire engine has yet to be invented which Gideon can carry on his shoulders.

(Continued on page 195)

THE GARDEN TAKES A FRESH LOOK AT MEMBERSHIP

WHY DOES The New York Botanical Garden have several classes of membership? What are the distinctions between them, and what are the reasons for moving upward from one class to another?

Such inquiries are made with sufficient frequency to warrant a fresh look at the meaning of membership, particularly in view of some changes made by the Garden's Board of Managers on September 1, 1960.

A good starting place is the constitution of the Garden, drafted sixty-nine years ago and still the keystone of the Garden's corporate structure. According to this document, the corporation was created "for the purpose of establishing and maintaining a botanical garden and museum and arboretum . . . for the collection and culture of plants . . . for the advancement of botanical science and knowledge, and the prosecution of original researches therein . . . for affording instruction in the same . . . and for the entertainment, recreation, and instruction of the people."

These purposes are reflected in today's membership classifications, even though at first glance there are no apparent distinctions. The annual member who pays dues of $10 has the same privileges as the life member who has contributed $1,000 or more. But there *are* distinctions, intangible perhaps, but real in the special and lasting satisfactions they bring to the individual.

Here's how we think of the various categories today.

ANNUAL MEMBERSHIP

Annual members paying dues of $10 a year constitute the largest part of Garden membership, and individuals in this group receive *The Garden Journal,* are entitled to discounts on fees for instructional courses, are permitted to park their cars and to ride on the "Floral Flyer" without charge, are offered plants from time to time free or at a special price, and generally enjoy a sense of being in a company of people whose interests in gardening and botany parallel their own.

When the cost to the Garden of providing these privileges has been subtracted from the dues, the balance might well be considered as being used in helping to maintain the Garden physically — in short, in pursuit of the stated purpose of providing *"recreation* of the people."

CONTRIBUTING MEMBERSHIP

Members in this category pay $25 a year and enjoy the same privileges as annual members. But here the difference in cost between the provision of membership privileges and the dues might be thought of as contributing toward the Garden's educational program.

Fees from students in the Garden's classes and from lectures delivered by staff members are hardly sufficient to maintain the educational function of the Garden. Almost everything in the Garden — from the labels on plants and trees through the Garden's publications, the replies by staff members to questions from members and visitors, and the displays in the museum — help the Garden fulfill its educational role.

Therefore, we think of members in this category as special *contributors* toward botanical and horticultural *education.*

SUPPORTING MEMBERSHIP

Members in this group, who pay dues of $100 a year, enjoy the same privileges as annual members but can in addition think of themselves as helping to support the Garden's third purpose: "the prosecution of original researches" in the botanical field.

Industrial companies and such institutions as the National Science Foundation frequently make grants in aid of specific research projects and expeditions under the Garden's auspices. But the day-in, day-out experimentation and research that go on in the herbarium, in the field of plant classification (taxomony), in the propagating houses, in the laboratories, the conservatory, and the gardens themselves, require special support, and sometimes the rate of progress in a significant investigation is governed by the funds that are available.

The supporting member is a pillar of strength in the Garden's recreational and educational activities, to be sure, but mostly his *support* is felt in the realm of *research.*

HUSBAND AND WIFE MEMBERSHIP

The newest category — husband and wife membership at $15 a year — is a variant on annual membership and was introduced on September 1, 1960 in response to a number of requests. Only one copy of *The Garden Journal* is delivered to the joint membership, and when a plant distribution offer is made, the terms are those that apply to a single annual membership. On the other hand, both husband and wife are eligible for the discount on tuition fees for Garden classes, and membership cards are delivered to both.

GARDEN CLUBS

Garden Club membership at $50 a year has mutual benefits. The garden clubs receive the Garden's publications, have access to staff members for advice and suggestions, are encouraged to come to the Garden for club tours and luncheons, and for a nominal fee of $25 can enrich their programs with an illustrated lecture by a staff professional. The Garden, on the other hand, benefits from their interest, their comments and suggestions, and their loyal support.

LIFE MEMBERS

Life members are those benefactors who pay dues of $1,000 or more in one single payment to the Garden. Many of the Garden's most attractive features are attributable to this kind of generosity. The payments are applicable to the Garden's normal operations.

ORGANIZATIONAL MEMBERSHIP

Finally, several industrial companies make flat annual payments — usually in multiples of $500 — to the Garden. They are called organizational members and might be grouped with the supporting members in the sense that they, too, have a continuing interest in the furtherance of plant research. Frequently throughout the year technicians representing these companies are in consultation with the Garden's experts.

As the Garden's researches expand, more and more manufacturers and distributors of medicines, foods, cosmetics, and many other familiar products are becoming organizational members.

THE PRESENT STATUS

Total membership in the Garden today is about 2,800. In view of the

Garden's international stature and its wealth of attractions, this seems like a modest total. On the other hand, membership has been increasing for the past two years at a rate which justifies the expectation of twice as many members in 1965 as the Garden had in 1955.

The Prospect for the Future

Obviously with a membership of this size, with dues scaled as they are, and with costs of maintenance continuing to rise, the Garden could not exist on dues and contributions alone. Fortunately, through its Department of Parks, the City of New York pays about half the cost of maintaining this 238-acre operation.

But the prospect of growth, of enrichment of the membership privileges, of better facilities, of the introduction of more rare and exotic plants, lies in the membership area.

Talk with almost any staff member and you are likely to be deluged with ideas as to what could be done in this beautiful setting. What *will* be done depends largely on a sustained growth in membership.

Henceforth *The Garden Journal* plans to publish quarterly lists of new members, and probably even a full membership roster. YOU can help importantly by inviting your friends to join. H.W.L.

In this issue we publish:

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Douglas H. Allen
Arthur M. Anderson
Mrs. Arthur M. Anderson
Mrs. Ernest Angell
Mrs. Elliott Averett
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Mrs. Robert Woods Bliss
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Garden Club of Orange and Dutchess Counties
Pawling Garden Club

(Continued on page 204)

PATTIKEWS (from page 192)

It was a notable conflagration. Much of Gideon's furniture was destroyed by it, including the Bible-box; but they saved his potatoes, and Mrs. Gideon's mangle and her stuffed owl. My memory of the scene, as a whole, is confused, but I remember that Mrs. Gideon was the object of devoted attentions from a group of feminine convives, who offered her vinegar and ale. And I remember that Mrs. Gideon wept continuously. I remember also that the youthful population of the parish was very numerously represented and that its proceedings were the object of constabulary attention. I likewise remember that hoarse-voiced men kept telling other hoarse-voiced men to "look out," because the roof was certain to fall in, which it ultimately did, among a cascade of sparks, but with a singular avoidance of noise or fuss.

That which I chiefly remember, however, is the peculiar conduct of Gideon Hemus.

When I first arrived at the scene of this illumination, Gideon was not visible. Other members of the audience told me that he had retired to a distant knoll, with a basket containing dirt and roots. I looked for this knoll and found it, just as the roof fell in.

Gideon sat among his baskets, nursing a spade. He had lighted a pipe and was smoking it, thoughtfully, as he gazed at the spluttering ruins of the house in "The Hole."

During the whole period of his vigil, he only uttered one speech:

"That's well alight," he said. "Burning strong. Hey?"

Mr. Kosky objected to this behaviour. He said, and caused it to be known that he had said, that it was extraordinarily suspicious behaviour. He said, and caused it to be known that he had said, that Gideon's conduct might have to form the subject of inquiry. In the meantime, he commanded the Hemuses to inhabit a newly-erected cottage on the top of Abbot's Hill.

Here the wind is an important horticultural factor, and here the pattikews throve amazingly.

VI

They were planted by Gideon in straight, bleak rows. The garden which they adorned was itself a singularly bleak and expressionless garden. It consisted of pure sub-soil, enjoying what is called an open situation. But the pattikews like it.

Gideon planted them in January. By the middle of March, they were in bloom. Not having ever seen a pattikew, and being curious to inspect the favourite flower of Mr. Hemus, I ascended that breezy height and looked at them.

I thought that they were interesting flowers; but a friend who was with me, and who is a Poet, used stronger language. "That isn't flowers," he said, "It's a piece of the sky which has fallen down."

He began to talk deliriously. Without pretending to countenance his unmanly emotion, I admitted that the flowers were nice. I even admitted that Gideon was perhaps right: that all this goodness was worth the trouble which he had been at to get it. I then opened the little gate which led to the garden.

"What are you doing?" demanded my friend.

"I am offering thanks," I replied, "to the man who grew these flowers." With that, I snatched a nosegay from the bed of pattikews.

We then walked to a house five miles away, at Cuckfield. In this house we found Gideon, who stated that he had left the house on Abbott's Hill, and was going to remain for the rest of his life at Cuckfield. His new and final habitation was called "The Cuckfield Workhouse."

I gave him the nosegay of pattikews, which he was very glad to receive. He said:

"Be they *moi* pattikews? They ha' took a-holt, then, arter all."

BOOK REVIEWS

HOW TO MAKE MONEY FROM YOUR HOME GREENHOUSE. Peggie Schulz. 324 pages, illustrated, indexed. D. Van Nostrand Company, Inc., New Jersey. 1959. $5.95.

This book is a well-written account of the many ways in which a small greenhouse may be operated to produce a financial return. This return may be a profit after an exact accounting of all costs. Or the owner may not keep books on his capital investment and the hours of personal labor required, and regard this return as an offset on the costs of maintenance. In any event, a cash return from the average small greenhouse is something most owners will welcome, and it is helpful to learn how such a result may be achieved.

This reviewer can find little to criticize, item by item, in this optimistic presentation. He knows, through a fairly extensive personal experience with small greenhouses and growing conditions ranging from dry cacti to lush growers in high humidity, that there is a factor for success in each of these recommendations. But this factor will often be greatly influenced by the competence of the individual, the geographical area involved, the character of the immediate neighborhood (residential, commercial, or rural), the actual existence of a paying market, the ability to supply and deliver on a promised schedule, and finally the tax status which may figure at the federal, the state, and the municipal level.

It is obvious from the text that the author has been most fortunate with respect to the influences just enumerated. In some of the larger cities the commercial outlets for plant material are so rigidly channeled that the small amateur stands no chance of establishing a market upon which he can count. In tax-hungry municipalities, commercial traffic in plants is certain to be assessed.

In conclusion, it may be said that anyone who would like to speculate in this intriguing pastime of making a small greenhouse pay will find this volume of great interest. He will be well advised to proceed cautiously, and test out, step by step, each idea that commits him to much expense or responsibility. In brief, do not spend the money your greenhouse brings in until you get it!

HAROLD E. ANTHONY
Englewood, New Jersey

HOW YOU CAN GROW BEAUTIFUL ROSES. John R. Whiting (ed. by). 143 pages, illustrated. Arco Publishing Co., Inc., New York. 1959. $2.50.

This book, a readable guide to rose growing for the amateur as well as expert rose fancier, contains many excellent, self-explanatory photographs. These are fairly complete and in one section offer many ideas for floral arrangements. There are, however, no illustrations or information on preparing roses for exhibition.

The editor, John R. Whiting, covers the main classifications of roses and discusses the individual aspects of each variety. There is a very good chapter on miniature roses which gives useful information about these tiny, perfectly formed, fully fragrant flowers. He also presents a good list of fragrant roses.

In a discussion of the hybrid teas, it is suggested that these plants be spaced two feet apart. This would not allow for full growth; spacing two and a half to three feet would reap better results.

Mr. Whiting mentions that it is inadvisable to over-prune the first year, and stresses the point that roses will grow in a variety of soils as long as there is humus. He notes that in different areas of the country, roses must be cared for differently. It is stated, too, that beautiful roses may be grown without the use of expensive special rose foods or fertilizer; instead one can favorably use compost and ordinary garden fertilizer plus trace elements.

Finally, the book advises against cutting, as the vigor of the bush is reduced if foliage is cut away.

This is an informative as well as an attractive addition to the home library.

A. D. MOLLIN
Great Neck, Long Island

A FIELD GUIDE TO TREES AND SHRUBS. George A. Petrides. 431 pages, illustrated, indexed. Houghton Mifflin Company, Boston, Mass. 1958. $3.95.

This addition to the Peterson Field Guide Series is outstanding for the amount of material it contains, and it offers much assistance to amateurs searching for the identities and salient characteristics of woody plants found growing wild in the general "Gray's Manual area." Approximately six hundred and fifty kinds of trees, shrubs, and woody vines are treated, including most of the ones naturalized from other parts of the world.

The author has worked diligently in simplifying descriptive terms. Pinnately and palmately compound leaves become "feather-compound" and "fan-compound" (sic), and one can only hope that students with any ideas about fans sometimes being made from and with feathers are sufficiently strong-minded to put these notions out of their heads. Attempting to set things straight by looking in the generally good short glossary, one finds no definition but a detour after *palmate,* to "See various *fan* prefixes." Similarly, under *pinnate,* one is passed on to the feather department.

Such a concise workaday term as *ovate* is all but outlawed from these pages—having been found just once, and not admitted to the glossary. It is replaced by *egg-shaped,* which applies equally to the leaves of silky dogwood and to the habit of sugar maple, and any tidy distinction between essentially plane and solid structures is not encouraged. Characterizing sugar maple as having a "Short stem; full egg-shaped head" (page 5) seems devastating.

Tree silhouettes are an attractive feature of the book, and they are convincingly done. Some descriptions of these drawings cause queries. White spruce, Norway spruce, and American larch are described as "pyramidal," while balsam-fir, red-cedar, and others are "conical." Pyramidal plant outlines result only from shearing and clipping to produce flat-sided specimens, and nature has other objectives in mind.

The book is attractively and durably made, and a valuable addition to popular guides to the world of trees and shrubs.

BENJAMIN BLACKBURN
Drew University
Madison, New Jersey

ILLUSTRATED GENERA OF RUST FUNGI. George B. Cummins. 131 pages, illustrated, indexed. Burgess Publishing Co., Minneapolis, Minnesota. 1959. $4.50.

The rust fungi, obligate parasites on ferns, conifers, and flowering plants, have received considerable study by mycologists, botanists, and plant pathologists. To the gardener they are known as the casual agents of serious diseases of many cultivated plants. From a taxonomic viewpoint the rust fungi are perhaps better known than any other major group of fungi. A vast amount of literature has accumulated, devoted to descriptions and classification of species of rust fungi. Since the literature is scattered in many journals and published in many languages throughout the world, it has been difficult to gain a clear picture of the kinds of rust fungi living in the world today.

Dr. Cummins of Purdue University, who is the leading taxonomic authority on rust fungi, has alleviated this problem by presenting, in this manual, keys, descriptions, and illustrations of the genera of the rust fungi (Uredinales) of the world. An introductory chapter reviews the morphology and terminology of the major structures of rust fungi and includes illustrations which clearly point out the distinguishing characteristics of each. A section on life cycles is included. The bulk of the manual consists of descriptions and illustrations for each of the ninety-five genera of rust fungi at present known in the world. The illustrations are the outstanding feature of the work and consist of photographs, schematic sketches, and drawings made from specimens with the aid of a camera lucida. For each genus, references to monographic and regional treatments are given.

The manual is a splendid contribution in the field of mycology and of plant pathology. It is another of the excellent spiral-bound manuals in botany published by Burgess Publishing Co.

CLARK T. ROGERSON

THE RELATION OF FUNGI TO HUMAN AFFAIRS. William D. Gray. 510 pages, illustrated, indexed. Henry Holt and Co., Inc., New York. 1959. $8.50.

At last a textbook has appeared which presents the potential and actual role of fungi in human affairs. Dr. Gray has written an excellent treatise and up-to-date summary of practical mycology, stressing the often unrecognized beneficial features of fungi to mankind. He clearly shows by the accumulated evidence that fungi are predominantly beneficial in man's welfare; at the same time recognition is given to the harmful role of fungi.

Following a brief but adequate introduction covering the morphology, classification, identification, number, isolation, and laboratory cultivation of the fungi, the book is divided into two parts. Part I dealing with the beneficial activities of fungi consists of eighteen chapters. The first of these presents a splendid portrayal of the vital role that fungi plays in the destruction of organic waste. Well-organized and clearly presented summaries of our knowledge on mycorrhizae, industrial mycology, direct utilization of fungi as food, fungi and food processing, production of livestock feed, fungi in medicine, alcoholic fermentation, synthesis of gallic, citric, gluconic, itaconic and kojic acids, fungus enzymes, glycerol and fat production, miscellaneous fungus activities, and use of fungi in biological assays form the larger portion of the text. Part II discusses the harmful activities of fungi and consists of six chapters dealing with plant disease, destruction of timber products, tropical deterioration, fungi in the paper industry, food spoilage, fungi as allergens, pois-

onous fungi and finally medical mycology.

Good illustrations complement the book throughout. A well-selected list of references is found at the end of each chapter.

Without question this book is the best available summary of our knowledge of practical mycology. It should be useful as a textbook as well as a reference book on the subject.

CLARK T. ROGERSON

A GUIDE TO THE HISTORY OF BACTERIOLOGY. Thomas H. Grainger, Jr. 210 pages, indexed. The Ronald Press Co., New York. 1958. $4.50.

"Why study the history of science" provides an excellent introductory chapter to this book. In it the author clearly points out the complete neglect or, at most, superficial coverage of the historical aspects of science. As he puts it, "in this so-called age-of-science, history is taught seemingly about everything but science." Using the history of bacteriology as an example of one which has been sadly neglected, the author then presents a guide which certainly will provide stimulation for anyone who is interested in bacteriology.

The guide consists of a selected list of reference sources and is designed especially to stimulate interest in and an appreciation of the history of bacteriology. The selective annotated bibliography is divided into four parts: (1) literature of bacteriology, including general references on all sciences, and references on bacteriology, (2) history of bacteriology with special reference to specific areas, e.g., actinomycetes, air, animals, bacteria, food, (fifty-three headings), (3) bibliographical references to bacteriologists, and (4) a selective guide to biographies of sixty outstanding bacteriologists.

The value of this book depends necessarily upon the selectivity done by the author for references included or excluded. Without question he had done a splendid job. The book will be of value and aid to research workers, librarians, bibliographers, and students as well as to any person who becomes interested in biology, particularly in some phase of bacteriology.

CLARK T. ROGERSON

PLANT BREEDING AND CYTOGENETICS. Fred C. Elliott. 395 pages, illustrated, indexed. McGraw-Hill Book Company, Inc., New York. 1958. $8.50.

The author well fulfills his purpose of providing a specialized text of value mainly to advanced students and practicing breeders. This book is an excellent guide to recent literature and gives deserved attention to fundamental genetical questions that may be neglected by the breeder only at high cost. The book is recommended for its integrative value as an addition to the plant breeding research library and for the stimulation it should offer to the graduate student.

A sample is submitted here of critical responses to certain controversial portions of the text. Favorable remarks should far outweigh adverse criticism, but this approach in review may serve to illustrate the content and vigorous nature of this book.

In stating that "the essence of a genetic system" is "the rate at which variation is released through recombination in each new generation," the author represents an extremely narrow view. Here, if not generally, genetic control of physiology and development is ignored. Elsewhere, it is concluded that "position effect . . . implies that the expression of a character is governed by interactions . . ., rather than by the discrete effects of the loci themselves." The expression "governed by" is too strong; a better choice of terms might be "is frequently *partially dependent* upon" interactions. Neither does it seem rigorously true that "natural selection . . . favors types which are near the mean for any characteristic."

In addition, issue may be taken with the conclusion that "it now appears likely that most mutations result from rearrangements within the chromosome." Further, the implication is not justified, generally, that mutations occur infrequently in homozygotes but that in "heterozygous material the spontaneous-mutation frequency may be relatively high." A more careful distinction should be made between the frequency of an event and the frequency with which it may be readily detected. Factual demonstration does not permit ready concurrence, either, with the summary that McClintock's dissociation-activator system in maize is "composed of two extra-genic elements." At still another point, alien chromosome addition races apparently are neglected in stating that plants "with a single extra chromosome are trisomes."

Furthermore, it is questionable that simply inherited forms of high resistance to disease "may be overcome by new mutants" (of infectious organisms) "quite readily." Rather, the outcome should depend strongly upon the basic physiological nature of the inherited resistance, which need not be simple, physiologically or genetically, despite simple Mendelian behavior in particular crosses.

The text also lacks critical evaluation in its unduly poetic prognosis for breeding programs by induced-mutation. Also, the book follows an expeditious but shortsighted line for the breeder, at one point, adhering closely to the economics of marketing. Optimal "sizes, shapes and other characteristics" of fruits and vegetables and "vigor, uniformity, and ultimate yields" are mentioned as breeding criteria. But certainly for broader service, additional breeding emphasis should be placed upon commonly neglected quality characteristics appreciated specifically on the consumer's table.

These remarks are severely selected, and certainly constitute relatively minor critical reservations to a complimentary judgment. Indeed, the possibility of such discussion is assured by Elliott, who intentionally has included speculative material in the text.

SEAWARD A. SAND
Genetics Department
Connecticut Agricultural Experiment Station

DISEASES AND PESTS OF ORNAMENTAL PLANTS. Pirone, P. P., B. O. Dodge, and H. W. Rickett. 775 pages, illustrated, indexed. The Ronald Press Co., New York. 1960. $10.00.

In recent years much emphasis has been given to ornamental plants and the insects, diseases, and physiogenic troubles that produce unsightly, weakened, and often dead trees, shrubs, flowers, and grass. In this regard, the first two editions of this book have proved to be of great interest and use to amateur and professional gardeners, and to students. But with copious new information being found by research workers and others on diseases and insects and especially on new and improved methods of control, a compilation of this widely scattered information is a necessity. Dr. Pirone has carefully prepared this third edition to fulfill

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the need of disseminating up-to-date information on pests and insects to all who are concerned with ornamental plants and especially with the diagnosis and treatment of the many maladies to which these plants are subject.

Dr. Pirone has made extensive use of information available in recent literature, although he has not listed any selected references with each topic which, in itself, would make this volume lengthy and costly, but at the same time more valuable as a text for students. He has written from his many years of experience as a phytopathologist at Cornell and Rutgers universities and as a consultant with The New York Botanical Garden. With this backgound, the senior author has been able to use the original editions by Drs. B. O. Dodge and H. W. Rickett, well-known pathologist and botanist, respectively, as his nucleus, his own and other recently published information as the cytoplasm, and over two hundred well-reproduced clear figures as the other cell inclusions. The cell walls are the good-quality paper, binding, and hard covers supplied by The Ronald Press Co., that are essential (in this age of paper covers and pulpy pages) for a reference book which will find frequent use.

The first portion of this comprehensive guide to pests and diseases of ornamental plants, or about one-sixth of the book, serves as a well-illustrated introduction about the causes of plant troubles and the symptom types, a well-founded understanding of which is necessary to diagnose adequately. Part I introduces the gardener to blotches, blights, beetles, bugs, and bagworms which beset him. Important emphasis is given in the early pages to the environmental conditions and cultural practices that are responsible for a good portion of the "symptomatic plants" which we encounter. The causes of plant diseases—fungi, bacteria, viruses, and nematodes are more than adequately discussed for the gardener and homeowner.

Insect classification, the more common insect pests and miscellaneous animal pests, including mighty important mites, are covered in Part I. Brief portions are given about the important diagnostic aids of recognizing insect injury types and patterns. Chapter 4 on "Control" is one of the most important portions of this third edition, since it brings one up-to-date on many of the new insecticides, fungicides, and nematocides. It should give the gardener information on *why* and *what* he is using or can use to combat diseases and insects. Dr. Pirone has also indicated in this chapter that there are many other control methods for diseases and insects other than the use of chemicals.

Part II, the greater portion of this authoritative guide, is an encyclopedia of information on diseases and pests of nearly five hundred ornamental plants. Dr. Pirone discusses most of the diseases and pests of ornamental plants regardless of their prevalence and importance. The symptom descriptions and control recommendations are nontechnical. This allows the book to be of much more value to the gardener than to the student. The alphabetical arrangement of material according to genera from *Abelia* to *Zinnia* found in the earlier editions has been followed. Even though this may mean that one must become familiar with scientific names, it has the value of making this a time-saving, ready-reference dictionary of diseases and pests.

This well-organized guide book of diseases and insects of ornamental plants should prove to be a valuable sourcebook to amateur and professional gardeners and to those concerned with the planting and maintenance of trees and shrubs. It may serve as a supplementary reference to the student.

STEPHEN BACHELDER
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New Brunswick, New Jersey

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MIOCENE FLORAS OF THE COLUMBIA PLATEAU. Ralph W. Chaney and Daniel I. Axelrod. Quarto, viii 237 pp., indexed, illustrated, 44 pls. Carnegie Institution of Washington (Contributions to Paleontology) Publication 617, 1959. Paper, $4.25; cloth, $4.75.

The authors present a comprehensive summary of Miocene floras within the highly fossiliferous Columbia Plateau of Washington, Oregon, California, and Idaho. Chaney and Axelrod, known as the most active exponents of western North American fossil floras and their historical and paleoecological interpretation, have contributed an invaluable addition to the already voluminous literature on this subject. The book is another indispensable piece in the puzzle of correlation toward the establishment of age relationships, recognizable botanical provinces, evolution, migration, and a continued trend toward modernization, leading eventually to the Recent flora.

More specifically the authors discuss and correlate such floras as the Latah, Republic, Grand Coulee, and Spokane from Washington; the Mascall, Blue Mountains, Stinking Water, Succor Creek, and Trout Creek floras from Oregon; the Thorn Creek, Payette, and Lower Idaho floras from Idaho; and the Upper Cedarville, Weaverville, Remington Hill, San Pablo, and Table Mountain floras from northern and northeastern California. These floras display equivalents to modern temperate forests in eastern North America and northeastern Asia, and indicate topographic diversity, changes of precipitation, and finally the extinction of most of the East Asian and East American elements. Paleobotanical "direct" evidence is used exclusively as the basis for reasonable interpretation of all relationships cited and is presented in forty-four plates containing 431 excellent figures of pertinent localities and foliar structures. This evidence is augmented by thirty-two tables, a thorough systematic revision of the Miocene flora of western North America that affects approximately seven hundred described specimens, and a list of rejected species. A voluminous bibliography of one hundred and ninety references enables the reader to expand his horizon of direct and peripheral studies of Miocene floras.

As an indispensable work for all students who are cognizant of Tertiary paleobotany, the book presents a thorough, forceful, and convincing summary of Miocene floras with age relationships in their proper perspective that can be accepted as the last word based on the most competent research.

HERMAN F. BECKER

PRINCIPLES OF PALEOBOTANY, 2nd ed. William C. Darrah. 295 pp., indexed, illustrated. The Ronald Press Co., New York. 1960. $6.50.

Darrah's first edition of *Principles of Paleobotany* (1939) was subject to severe, general criticism regarding choice of subject matter, accuracy of contents, and the freedom with which the author quoted at great

length from other authors without acknowledging the source. Within the framework of relative brevity of the second edition, many of these shortcomings are alleviated.

The content follows a conventional arrangement of discussions on principles, history, techniques, the early plant record through Cenozoic floras, the origin of the existing flora, pollen analysis, evolution and phylogeny. Randomly selected inaccuracies of the first edition are largely corrected, but a few glaring errors have remained. Consistency in proper presentation in Tables 2-5 of age relationships for geologic sequence, cultural and historical changes, sequence of floras or sequence of genera and species within a time period, should have been maintained in that it is customary to place the earliest (oldest) events on the bottom as was properly done in Tables 1 and 10-12.

While the chapter on pollen analysis, if short, is a welcome addition, the chapter on Tertiary paleobotany should not have been cut from twelve to eight pages, but rather expanded. From a strictly evolutionary and taxonomic point of view, and closely relating to our modern flora, the vast accumulations of Tertiary plants, the great number of regional, distinct, epochal floras, offer a far-reaching opportunity for the interpretation of ancient climates, migration, evolution, and ecology. In order to stimulate prospective students, these aspects of the Tertiary ought to be a major concern of a text. Classical work in this respect by R. W. Chaney, E. Dorf, and D. I. Axelrod is negligibly treated if not ignored. A bibliography, usually indicative of the thoroughness in research, should be extensive since the prospective reader and student must be given not only a choice, but an overview of the field as a whole. In this respect, a short chapter on the prevailing journals and other literature dealing with paleobotanical aspects would have been appropriate. Many important works were apparently not consulted, or are, at least, not cited. One of the references omitted, without which basic progress in modern paleobotany is greatly hampered, is Oliver LaMotte's *Catalogue of Cenozoic Plants of North America through 1950*. This work saves untold time and effort in preparing the foundation for all paleobotanical research, namely identification of specimens upon which the interpretation of Tertiary events is based.

Generally speaking, the book is superior to its first edition, but appears to lack a certain thoroughness and the infallible competence that is expected in a text. One cannot but help compare the book with a similar, widely used text by Chester A. Arnold (1947) of which a second edition is now in preparation. In all probability Arnold's revised edition will remain the leading text of paleobotany in this country.

HERMAN F. BECKER

PLANT PATHOLOGY: Problems and Progress, 1908-1958. C. S. Holton, G. W. Fischer, R. W. Fulton, Helen Hart, S. E. A. McCallan, (ed. by). 588 pages, illustrated, indexed. University of Wisconsin Press, Madison, Wisconsin. 1959. $8.50.

Here is ample proof that the science of plant pathology has come of age. It contains important papers contributed by fifty-one of the world's leading authorities in pathology and related fields to help celebrate the fiftieth anniversary meeting of the American Phytopathological Society at Bloomington, Indiana, in August 1958. The articles are of interest not only to plant pathologists but to geneticists, plant physiologists, and biochemists. Although most of the articles are too technical for amateur gardeners, this volume will no doubt fall into the "required reading" category for plant pathologists and others working in related fields.

P. P. PIRONE

GREEN UNIVERSE. Dolan, Edward F. Jr., 244 pages. Dodd, Mead and Co., New York. 1959. $3.50.

Mr. Dolan has written a colorful, fast-moving biography of the German naturalist, Alexander von Humboldt. From the time Alexander and his partner, Aime Bonpland, sailed for the New World on June 5, 1799, the reader is caught in the excitement of their adventures on the Orinoco in northern South America; in Cuba; in Mexico; in the United States. This reader found von Humboldt's meetings with Thomas Jefferson particularly warming. Things slow down a bit when von Humboldt returns to Europe many years later but only so that he may write of his experiences.

Anyone with a bit of adventure in his restless soul will enjoy *Green Universe.*

BERNICE WINKLER

THE CONTROL OF GROWTH AND FORM. Wigglesworth, V. B. 140 pages—illustrated, indexed. Cornell University Press, Ithaca, New York. 1959. $3.00.

Dr. Wigglesworth has been able to construct, from a series of lectures given at Cornell University, a short and interesting book. He has written what amounts to a good review of the molting phenomenon of insects. The student of insect physiology will find this a helpful guide and adjunct to the literature of hormonal control of metamorphoses.

GEORGIA E. MANOS

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NEWS, NOTES and COMMENTS

Reception for Graduates at the Garden. The terrace at the Snuff Mill, along the Bronx River, furnished a delightful setting on the evening of June 21, 1960, for the reception tendered the graduates in the Two-Year Courses in Botany and Practical Gardening. T. H. Everett, Assistant Director (Horticulture) and Curator of Education, introduced Dr. George L. McNew, Managing Director of the Boyce Thompson Institute for Plant Research Inc., to the graduates, their relatives, and other guests. Dr. McNew's address on "Molecules in the Life of a Plant" appears on page 193 of this issue.

Mrs. Hermann G. Place, Vice President of The New York Botanical Garden, presented certificates to the graduates: in the Two-Year Course in Botany — Agnes B. Davis, Robert Russo, Genevieve W. Senber, Esther Streifus, and Morton A. Waldman; in the Two-Year Course in Practical Gardening — Abbie Bromley, Phyllis Bruno, Marcello Candia, William Cahill, Helene de Roetth, Mae G. Greene, Matthew Kabriski, William F. Korker, Joseph L. Owades, Polly Schinman, Henry Sitterman, and Theresa R. Waterman.

Activities of the Director and Staff. During the past several months, Dr. William C. Steere, Director, attended a panel meeting in New York City of the American Cancer Society at which funds were appropriated for research projects at universities and colleges; a meeting of the National Research Council on international meetings and Congresses in the biological sciences and a meeting of the Board of Directors of the American Horticultural Society, both in Washington, D. C.; and the annual meeting of the Board of Directors of the Bayard Cutting Arboretum at Oakdale, Long Island.

Dr. Steere, accompanied by Mrs. Steere, spent the month of July on a field trip in northern Alaska to study and evaluate arctic mosses. The trip was made under a grant from the Arctic Institute of North America.

Yuki Nobu Kuwahara, who is working for his doctorate at Columbia University, is assisting Dr. Steere under the latter's grant from the National Science Foundation for the study of Arctic American mosses. Mr. Kuwahara received his M.S. in bryology at Miami University, Oxford, Ohio, under Dr. H. A. Miller of the Department of Botany. Dr. Miller was a student of Dr. Steere at the University of Michigan.

T. H. Everett, Assistant Director (Horticulture) and Curator of Education, and Louis P. Politi, Horticulturist, visited the Arnold Arboretum, Jamaica Plains, Massachusetts.

Dr. Annette Hervey, Research Associate, is teaching a course in general botany at Hunter College during the summer session. Dr. Hervey taught a course in microbiology at Hunter College two evenings a week during the last semester under the Teacher Education Program.

Dr. David J. Rogers, Curator of Economic Botany, returned from his Jamaican and Brazilian trip, made on behalf of UNICEF, with frozen samples of foliage of twenty varieties of *Manihot esculenta* (cassava or tapioca-plant) for testing purposes to determine the nutritive value in the hope of finding desperately needed protein supplements for the diets of under-nourished children. Cassava, which is already used for its starchy roots, may provide a ready source of protein in its leaves.

The Animal Wildlife Institute asknowledges assistance received from Dr. Marjorie Anchel and Dr. Alma Barksdale, Research Associates, Charles C. Clare, Jr., botanical artist, Dr. Richard M. Klein, Alfred H. Caspary Curator, and Dr. Rogers in the preparation of *Humane Biology Projects*. Publication of this manual was made possible by the Ingram Merrill Foundation.

Dr. Klein has been elected a member of the Council of the new Society for Cell Biology; he represents The New York Botanical Garden through his curatorship and the Botanical Society of America through his membership in the Growth Development Section.

Dr. P. P. Pirone, Plant Pathologist, and Dr. Hervey showed the Garden's facilities to a group of almost one hundred members of the New York Teachers' Association of Biological Sciences on their visit to the Garden this summer.

Miss Elizabeth Hall, Librarian, became the Sarah Gildersleeve Fife Research Librarian of The New York Botanical Garden on August 15, 1960. On the same date, James Daly assumed the duties of Administrative Librarian.

Members of the staff who plan to attend the joint meetings of biological societies sponsored by the American Institute of Biological Sciences at Oklahoma State University, Stillwater, August 28-September 1, 1960, are: Dr. William C. Steere with Mrs. Steere, Dr. Arthur Cronquist, Dr. Clark T. Rogerson, Dr. David J. Rogers, Dr. Richard M. Klein with Mrs. Klein. Dr. Klein will be chairman of the symposium on "Metabolic Activation in Cell Development" which is jointly sponsored by the Development Section of the Botanical Society of America and the American Zoological Society. Dr. Cronquist will introduce the symposium on Floras. Dr. Steere will present a paper on the "Progress in Arctic Bryology" before a session of the American Bryological Society and one on "A Taxonomic Tool" before the Botanical Society of America. He will also deliver the address at the annual banquet of the latter society.

Richard Haard, who was graduated in June 1960 from the University of Georgia with a B.S. degree in plant pathology, is assisting Dr. Clark T. Rogerson, curator of the Cryptogamic Herbarium in his study of the *Hypocreales* under the latter's grant from the National Science Foundation.

Ronald Peterson, who was awarded the Gertrude S. Burlington Scholarship in mycology the summer of 1959, was awarded the scholarship again in 1960. Working on a taxonomic survey of the aquatic *Hyphomycetes* in the New York City area, Mr. Peterson has engaged in field work this summer with headquarters at the Garden. This survey is part of Mr. Peterson's program for his doctorate at Columbia.

Dr. Trevor McMorris will join the staff of the Research Laboratory under Dr. Marjorie Anchel this month. Dr. McMorris received his B.S., in 1952 and his M.S., in 1954 from London University. From 1954-57 he was Assistant Lecturer in Chemistry at the University College of the West Indies and during those years did research toward his doctorate which he obtained in 1958. In October 1957 he worked with Prof.

On June 24, 1960, Mr. and Mrs. Hermann G. Place entertained members of the Garden's staff at their home in Millbrook, New York. Photographed with Mrs. Place (right) are Mrs. John W. Donaldson and Dr. William C. Steere. Mrs. Place is Vice President of The New York Botanical Garden and chairman of the very successful drive for funds for the new library wing.

B. Lythgoe at Leeds University on an Inter-University Council Fellowship; a year later he moved on the same fellowship to Imperial College where he worked with Prof. D.H.R. Barton. Dr. McMorris comes to the Garden from the Department of Chemistry of the University of Western Ontario, where he has been working with Dr. Paul de Mayo on a N.R.C. Fellowship.

Theodore M. Barkley, who has been a graduate student assistant in the Herbarium under Dr. Arthur Cronquist, Curator, while he was working for his doctorate, was awarded his Ph.D by Columbia University on June 27, 1960. Mr. Barkley's thesis was "A Revision of *Senecio aureus* Linn., and Allied Species." Dr. Barkley has accepted a position as instructor with the Department of Biology at Occidental College, Los Angeles, California.

Thomas P. Pirone, eldest son of Dr. P. P. Pirone, received his Ph.D in plant pathology at the University of Wisconsin, Madison, Wisconsin, on June 6, 1960. He recently accepted the position of assistant professor in the Department of Plant Pathology at the University of Louisiana, Baton Rouge.

Newbold Morris was appointed Commissioner of Parks of the City of New York by Mayor Wagner. Mr. Morris succeeded Robert Moses, who had held the office for more than twenty-five years, and assumed his duties the latter part of May 1960. He has long been interested in municipal affairs and was particularly active when La Guardia was mayor. Mr. Morris, whose family is one of the city's oldest, is a member of the law firm of Lovejoy, Morris, Wasson, and Huppuck. He is active in the affairs of the Park Association of New York City. As Park Commissioner, Mr. Morris is an ex-officio member of the Board of Managers of The New York Botanical Garden.

Dr. James E. Canright, Associate Professor of Botany, Indiana University, will engage in research on primitive families of flowering plants in the Malaysian region, under a 1960-61 Guggenheim Fellowship. His centers of operation will be the Botanic Gardens at Bogor and the Singapore Botanic Gardens.

Dr. Thomas G. Pridham has received the U. S. Department of Agriculture Superior Award and Silver Medal for his contribution to the identification and classification of microorganisms in the Actinomycetes. Dr. Pridham, a microbiologist in the Fermentation Laboratory at the Northern Utilization Research Development Division, Peoria, Illinois, conducted his investigations as part of the research program of the Agricultural Research Service of the U. S. Department of Agriculture.

Dr. Donald F. Jones, who retired on June 30, 1960, after serving forty-five years on the staff of the Connecticut Agricultural Experiment Station, spoke on hybrid corn at the Station's "Research on Parade" field day, August 10, 1960. Dr. Jones is well qualified to tell the story of hybrid corn, the product of genetic research that contributes so much to the agricultural abundance of this country. Forty-three years ago, in an experimental plot at Mt. Carmel, Connecticut, Dr. James made the double cross of four inbred lines of corn. This technique, and his explanation of hybrid vigor, set the stage for the practical production of hybrid corn. Dr. Jones is a member of the National Academy of Science, and his work has been recognized by many organizations including the Botanical Society of America.

This area at the entrance to the home of Mrs. John W. Donaldson in Millbrook, New York, features small rare wildflowers that like acid soil.
Mrs. Donaldson, a member of the Committee on the Native Plant Garden that is being created at The New York Botanical Garden, has contributed a substantial gift toward the development of this garden and also generously donates fees from her lecture on "Wildflowers, a Neglected Element in Garden Design."

Dr. Doyle E. Peaslee has been appointed to the staff of the Connecticut Agricultural Experiment Station and will investigate methods of testing soils for plant food elements. He will begin with an examination of tests for calcium. The Morgan soil-testing system, that was developed by the Station and is used in more than twenty countries, relies upon an extracting solution which imitates the action of plant roots in drawing nutrients from the soil. Sometimes the amount of calcium available to the plant may be inaccurately estimated by this system. A fairly exact estimate of calcium availability is critical for growers of such plants as tobacco, potato, and laurel which require relatively large amounts of calcium but are injured by excess lime.

Paul Mason Tilden has succeeded Bruce M. Kilgore as Editor of *National Parks* magazine. Mr. Tilden was Assistant Editor of *Nature Magazine* until its merger in January 1960 with *Natural History,* when he became Associate Editor of the latter. Mr. Kilgore is now Managing Editor of the expanded publishing program of the Sierra Club, San Francisco, California, and of the *Sierra Club Bulletin.*

The International Society for Horticultural Science was officially organized in March 1960 at The Hague, The Netherlands. Eighteen member countries were represented at the meeting. Dr. A. B. Lecrenier of Belgium was elected President; Dr. H. B. Tukey of Michigan State University, Vice President; and Dr. G. deBakker of The Netherlands, Secretary-Treasurer. The next International Horticultural Congress is scheduled to be held in Brussels, Belgium, in September 1962.

Plant Hardiness Zone Map, a publication of the Agricultural Research Service, U. S. Department of Agriculture, may be had from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 15c per copy. This fine hardiness map and the accompanying lists of plants as "indicators of the cultural possibilities of each zone" will be useful to all growers—amateurs, commercial, and professional.

It was prepared by Dr. Henry T. Skinner, Director of the U. S. National Arboretum, as chairman of a commission of the American Horticultural Council (now the American Horticultural Society) which conducted studies on winter hardiness of ornamental plants. These studies were made on the recommendation of the American Association of Nurserymen.

American Institute of Biological Sciences Translation Program. The American Institute of Biological Sciences is currently translating and publishing seven Russian research journals in biology. These journals are translated with support from the National Science Foundation, which is eager that such information be more widely distributed to biologists throughout the world. It is hoped that this material will aid biologists in research, prevent duplication of work, give some idea of the work being done by Soviet scientists in the field of biology, and also bring about a better international understanding among scientists.

Because of the support of the National Science Foundation, the AIBS can offer these translations at a fraction of their publication costs, with even further price reductions to AIBS members and to academic and non-profit libraries. This reduction

places the translation within the reach of all biologists.

The journals currently being translated are *Doklady*: Biological Sciences Section; *Doklady*: Botanical Sciences Section; *Doklady;* Biochemistry Section; *Plant Physiology, Microbiology; Soviet Soil Science;* and *Entomological Review.* The AIBS has also instituted a separate program of translation and publication of selected Russian monographs in biology. It was felt that the program of journal translations was not sufficient to cover all the significant work being done in all fields of biology by Russian scientists. With the aid of competent authorities, the AIBS has translated and published six Russian monographs and one monograph is in the process of being published. In addition, several prominent monographs in various biological areas are being considered by the AIBS and the National Science Foundation for translation and publication.

The monographs that have been published are *Origins of Angiospermous Plants* by A. L. Takhtajan; *Problems in the Classifications of Antagonists of Actinomycetes* by G. F. Gauze; *Marine Biology,* Vol. XX, *Trudi:* Institute of Oceanology, edited by B. N. Nikitin; *Arachnoidea* by A. A. Zakhvatkin and *Arachnida* by B. I. Pomerantzev. The manuscript for "Plants and X rays" by L. P. Breslavets is in the final stages of preparation and should be published early in 1960.

Additional information about this program may be obtained by writing to the American Institute of Biological Sciences, 2000 P Street, N. W., Washington, D. C.

The National Wildlife Federation and state affiliates offer scholarships and fellowships to qualified individuals who are studying in the field of conservation and conservation education. Appropriate activities include resource management, teacher training, curriculum problems, textbook development, radio and television, scouting and conservation, farmer-sportsmen relations, conservation workshop techniques, state programs, and journalism. For application blanks and further information on James Hopkins scholarships for undergraduate students up to $500, graduate student fellowships up to $1,000, and post-graduate fellowships or special project grants up to $1,000, write before November 1, 1960 to Executive Director, National Wildlife Federation, 1412 Sixteenth St., N. W., Washington, D. C.

Panel on Food Additives. Dr. Detlev W. Bronk, President of the Rockefeller Institute for Medical Research and of the National Academy of Sciences, served as chairman of a panel of nine experts who were called upon by President Eisenhower's Science Advisory Committee to study and report on the use of additives in producing and processing food. Among the other panel members were Dr. J. George Harrar, Vice President of the Rockefeller Foundation, Dr. Harold C. Hodge, Professor of Pharmacology and Toxicology of the University of Rochester, Dr. James H. Horsfall, Director of the Connecticut Agricultural Experiment Station, and Dr. C. N. Hugh Long, Sterling Professor of Physiology of Yale University.

The panel recommended that the U. S. Secretary of Health, Education, and Welfare appoint a board of scientists to assist him in evaluating scientific evidence on the basis of which decisions may be made in permitting or prohibiting the use of certain chemical food additives.

Fifteenth American Horticultural Congress will be held November 10-12, 1960, with headquarters at the Huntington-Sheraton Hotel, Pasadena, California. Dr. G. W. Beadle, Nobel Laureate and Dean of Faculty, California Institute of Technology, will be the speaker at the President's Dinner on the first evening after a tour of the Huntington Botanical Gardens.

The second day will be spent at the Los Angeles State & County Arboretum, Arcadia, and the morning of the last day will be devoted to a tour of nurseries in the area.

Dr. David Davis will pursue research on the physiology of selective pathogenicity in *Fusarium* in the Research Laboratory. Dr. Davis comes to the Garden from Merck, Sharp and Dohme where he has been plant pathologist since 1955. Dr. Davis obtained his doctorate from the University of Illinois in 1950. From 1950-55, he held a post-doctoral fellowship in the Crop Protection Institute at the Connecticut Agricultural Experiment Station.

Dr. Lee W. Lenz, Director of Rancho Santo Ana Botanic Garden, Claremont, California, will return shortly from his six-month leave from the Botanic Garden for travel and study in Europe. While in Portugal, Dr. Lenz collected *Iris subbiflora,* authentic material of which is rare in cultivation. He also visited the villa belonging to the Campo Bello at Oporto in order to see what may be the oldest and largest specimens of camellias in the western hemisphere. The trunks of the largest measure eighteen to twenty-four inches in diameter, and they are almost thirty feet tall. Records indicate that the plants were brought to this villa from Japan about 1550.

Visitors to the Garden. The following have visited The New York Botanical Garden within recent months:

Dr. Henry K. Svenson, Washington, D. C.
Fred Cassebeer, Nyack, N. Y.
Mr. and Mrs. Kenneth Smith, Dongan Hills, Staten Island.
Mr. and Mrs. F. P. Walter, Upper Montclair, N. J.
Mr. and Mrs. Ira Woods, New Providence, N. J.
Philip Alampi, Secretary of Agriculture, State of New Jersey, Trenton, N. J.
Kenneth Bobronsky, Bronx Science High High School, New York, N. Y.
Richard Staples and
R. Syawananda and
Joyce Bado, Boyce Thompson Institute for Plant Research, Inc., Yonkers, N. Y.
Miss Suzanne Bourgeois and
Dr. Jean-Marie Wiame, University of Brussels, Belgium.
Father Sebastian Girzone, O. C., New York, N.Y.
Dr. Raymond J. Bannister, Dept. of Pharmacy, University of Saskatchewan.
Father J. Dundon, St. Louis University, St. Louis, Mo.
Robert B. Gambino, Westchester County (N. Y.) Agricultural Agent.
Dr. Trevor McMorris, University of Western Ontario, London, Ont.
Dr. H. Potter, Michigan State University, East Lansing, Mich.
Dr. Kathe Schwarz, Instituto Biológico, São Paulo, Brazil.
Dr. Jennie Simpson, Hunter College, New York, N. Y.
Dr. Frits W. Went, Director, Missouri Botanical Garden, St. Louis, Mo.
Joseph Swan, Farmington, Conn.
Gordon Wasson, New York, N. Y.
Dr. Lyndon O. Brown, Bronxville, N. Y.
John B. Gambling, Oldfields, N. J.
Sir Joseph Hutchinson, United Nations.
Newbold Morris, Commissioner of Parks, New York, N. Y.
Charles B. Harding, Rumson, N. J.
Mrs. Hermann G. Place, Millbrook, N. Y.
Lewis Anderson, New York, N. Y.

BOOK REVIEWS

ANATOMY OF SEED PLANTS. Esau, Katherine. 376 pages, illustrated, indexed. John Wiley and Sons, Inc., New York. 1960. $6.95.

Anatomy of Seed Plants is not merely an abbreviated version of the author's earlier *Plant Anatomy.* It is an up-to-the-minute, balanced, scholarly treatment of a subject which has grown by leaps and bounds within the last decade, by the one most eminently qualified to present it.

The first thirteen chapters deal with the types of cells and tissues in seed plants, and with the embryo; in the next nine chapters root, stem, leaf, flower, fruit, and seed are considered. Fewer developmental details and less historical background are included than in the earlier volume, but the discussions are clear, terse, and modern. Each chapter ends with a relatively short list of mostly recent, significant references, and the index

Dr. Ernest Guenther, Vice President of Fritzsche Bros., New York City, (left) gave the presidential address at the dinner of the Society for Economic Botany on May 21, 1960. Dr. C. O. Erlanson, Chief, New Crops Research Branch, U.S.D.A. Agricultural Research Section, Beltsville, Maryland, (center) is Chairman of the Society's Council; and Dr. David J. Rogers, Curator of Economic Botany at The New York Botanical Garden, (right) is Chairman of the Society's Program Committee.

BOOK ORDERS

Books reviewed in *The Garden Journal* or any other book on botany, horticulture, nature study, conservation, flower arranging, or kindred subjects may be ordered through Book Service.

Members are entitled to 10% discount on the list price.

When you place an order for books, please send check or money order, made out to

The New York Botanical Garden, to Book Service.

is preceded by an exceedingly helpful glossary.

A limited number of the illustrations have been taken from the earlier book, but many are new and the rest have been carefully culled from publications of the last few years.

The *Anatomy of Seed Plants* ties this vast subject together in a neat, new, crisp package; in the usual Esau tradition, it is a masterpiece.

EDWIN B. MATZKE
Department of Botany
Columbia University

LIGHT AND PLANT GROWTH. Van der Veen, R. and G. Meijer. 161 pages—illustrated, indexed. The MacMillan Company, New York. 1960. $8.50.

This book discusses the various aspects of the influence of light on plants. Photosynthesis, phototropism, and photoperiodism are discussed and set the stage for the ensuing study of the uses of light in horticulture. This book is concluded with a chapter on the design and use of artificial lights in horticulture.

Although well written, and for the most part clearly illustrated, this book is too advanced for the general reader. The practicing plant grower and the more advanced reader, preferably with some background in plant physiology, will find this book of interest. The data reported is recent, and the literature coverage wide; regrettably, the bibliography is very skimpy.

JACQUES LIPETZ

THE GARDENER'S WORLD. Krutch, Joseph Wood. 476 pages, illustrated. G. P. Putnam's Sons, New York. 1959. $8.95.

This is an extraordinary book. It is an anthology — and what, after all, is more suitable for persons interested in flowers? But what an anthology! Any book that can embrace between two covers Theocritus, Colette, Thoreau, Lewis Carroll, Darwin, Boccacio, and H. G. Wells merits some sort of medal. It is an assembly of selections from the literature of the western world that has to do with gardens or with plants in other aspects. (Asia, curiously enough, is not represented). The extracted passages are arranged in "sections" under such headings as "The pleasures of gardening," "Herbalists and early garden books," "Fashions in gardens," "The Linnaean age," and so forth. The compiler contributes an introduction and brief notes on the authors and their times.

This bespeaks a vast literary acquaintance; I had almost said a vast erudition — but a certain inaccuracy in details precludes such a title. Linnaeus' name was Carl, not Carolus nor Charles. The *title* of Parkinson's best-known work was not "Paradisi in sole paradisus terrestris" (as Krutch himself makes clear in another place). Francois André Michaux would be better so designated rather than by the "F. Andrew Michaux" that his Philadelphia publishers foisted on him. Nevertheless, he seems to be confused with his father André Michaux. And Nuttall added three, not two, volumes to Michaux's *North American Sylva,* the passage quoted being published in 1842, not 1849.

The book is not a credit to the American book designer. The type is well chosen, the page well designed; but the potentially charming illustrations (taken mainly from old books) are printed on paper of a repulsive yellow-green color which fights ferociously with the green of the cover. On the cover are three roses in various unhappy colors, which certainly add little to its attractions.

All in all, though, I am grateful to Krutch for introducing me to several authors of whom I had never heard and for giving me a wholly new and delightful aspect of Colette.

H. W. RICKETT

A DIDEROT PICTORIAL ENCYCLOPEDIA OF TRADES AND INDUSTRY. Diderot, Denis. 2 volumes. Indexed and illustrated—485 plates. Dover Publications, Inc., New York. 1959. $18.00.

The encyclopaedists of the eighteenth century, and Denis Diderot in particular, sought to bring together and make available to all the science and technology that were rapidly changing man's outlook on nature. In the famous *Encyclopédie* they also advocated democracy and represented the anticlerical currents of the time. The two present volumes contain only the plates dealing with "trades and industry"—including agriculture. Each plate is accompanied by an informative note by the erudite editor. The total effect is a vivid picture of the daily life of France in the period that preceded (and generated) the Revolution.

H. W. RICKETT

THE GENETICAL THEORY OF NATURAL SELECTION. Fisher, R. A. 284 pages, indexed, illustrated. Dover Publications, Inc., New York. 1959. $1.85.

A new issue of a standard work.

H. W. RICKETT

EXCURSION FLORA OF THE BRITISH ISLES. Clapham, A. R., T. G. Tutin, and E. F. Warburg. 579 pages, indexed. Cambridge University Press, New York. 1959. $4.50.

A condensed edition of the well-known *Flora of the British Isles* by the same authors.

H. W. RICKETT

A HERBAL OF ALL SORTS. Grigson, Geoffrey. 96 pages, illustrated. The Macmillan Company, New York. 1959. $2.50.

Another delightful work by the author of The Englishman's Flora. "This small Herbal . . . is about virtues medicinal, magic, supernatural, aesthetic, and treasure-trove; a personal notebook about plants, . . ." Plants are roughly in alphabetical order of common names, and there are articles on "Botanomancy" (if you don't know what that is, read the book!), "Fungal Snobbery," "Herb-Women," "Strewing Plants," "Unlucky Plants," and many other miscellaneous topics. I wish more poets would write on plants!

H. W. RICKETT

WILDFLOWERS, A NEGLECTED ELEMENT IN GARDEN DESIGN

A 45-minute lecture developed by Mrs. John W. Donaldson of Deep Hollow Farm, Millbrook, New York, for The New York Botanical Garden shows wildflowers planted in the designed garden, as well as in entrance and living areas around the house.

Moss, wild ginger, European ginger, and wintergreen ferns are used as borders.

The lecture emphasizes the necessity for expert propagation of our rare native plants to be introduced into horticulture in order that our gardens may become perpetual sanctuaries for our wonderful heritage of native plants.

The fee is $50, which is turned over to The New York Botanical Garden, for the development of the Native Plant Garden.

TREES OF THE SAN FRANCISCO BAY REGION. Metcalf, Woodbridge. 72 pages, illustrated. University of California Press, Berkeley, California. 1959. $1.50.

An illustrated, non-technical handbook for the layman.

ARTHUR CRONQUIST

NATURAL SELECTION AND HEREDITY. Sheppard, P. M. 212 pages, indexed. Philosophical Library, New York. 1959. $6.00.

A textbook-style presentation of "some recent ideas on the mechanism of evolution in the light of modern genetics," as simply written as the subject permits, and with two introductory chapters "explaining the elementary principles of heredity."

ARTHUR CRONQUIST

EDIBLE WILD PLANTS OF WEST VIRGINIA. Gillespie, William H. 118 pages, illustrated, indexed. Scholar's Library, New York. 1959. $2.50.

This booklet lists, by common and scientific name, over two hundred kinds of wild plants which can in some way provide food or drink for man, indicating the use and manner of preparation of each. The excellent line drawings are the only means of identification provided.

ARTHUR CRONQUIST

POCKET FIELD GUIDE TO TREES. Grimm, William Carey. 143 pages, illustrated, indexed. The Stackpole Company, Harrisburg, Pennsylvania. 1959. $1.50.

The book consists mainly of a series of excellent drawings of leaves, twigs, flowers, and fruits of trees of eastern United States, one species to a page, extracted from the author's *Book of Trees,* published in 1957.

ARTHUR CRONQUIST

FRUIT KEY & TWIG KEY TO TREES AND SHRUBS. Harlow, William M. 56 pages, indexed, illustrated. Dover Publications, Inc., New York. 1959. $1.25.

This new Dover edition first published

in 1959 is an unabridged and unaltered republication of the first edition of *Fruit Key to Northeastern Trees,* and the fourth revised edition of *Twig Key to the Deciduous Woody Plants of Eastern North America.* Both books are bound as one.

ARTHUR CRONQUIST

DRAWINGS OF BRITISH PLANTS — Part XIII. Ross-Craig, Stella. Illustrated and indexed. G. Bell & Sons, Ltd., London, England. 1959. 9s6d.

A series of beautiful, technically accurate line drawings. When finished, the series should be the definitive work in its field.

ARTHUR CRONQUIST

TAXONOMY OF FLOWERING PLANTS. Porter, C. L. 452 pages, illustrated, indexed. W. H. Freeman & Company, San Francisco, California. 1959. $6.75.

A well-illustrated elementary text, mainly Besseyan in approach, emphasizing selected orders and families.

ARTHUR CRONQUIST

A FLORA OF SOUTHERN ILLINOIS. Mohlenbrock, R. H., and J. W. Voigt. 390 pages, illustrated, indexed. Southern Illinois University Press, Carbondale, Illinois. 1959. $7.50.

A standard local flora, with keys and comments, "prepared for use by anyone having an interest in our native flora and who has had some introductory study of botany."

ARTHUR CRONQUIST

UTILIZATION OF NITROGEN AND ITS COMPOUNDS BY PLANTS. 385 pages—illustrated. Academic Press, Inc., New York. 1959. $9.50.

This volume presents the papers delivered at the Thirteenth Symposium of the Society of Experimental Biology held at the University of Reading from September 15-19, 1958.

ALMA W. BARKSDALE

PLANT GROWTH SUBSTANCES. 2nd Edition. AUDUS, L. J. 553 pages—illustrated, indexed. Interscience Publishers, Inc., New York. 1959. $10.00.

This is one of a series of Plant Science Monographs edited by Nicholas Polunin, designed to present detailed and documented surveys of scientific research pertinent to the feeding and clothing of man. In the present volume, the nature of plant auxins and their application to agriculture are discussed.

ALMA W. BARKSDALE

LETTERS TO THE EDITOR

I was most interested in the article on "Native Eastern Azaleas" in the May-June 1960 issue. The Southampton Colonial Society is developing a native woodland, in a small way, on its grounds. For months I have been trying to find the native azalea shrubs. Last week a local woman sent me a spray with the most beautiful pink to deep pink flowers; she did not know the name of this azalea. At last I found the plant in *Plants of Colonial* Days and now in this article in *The Garden Journal.*

The Southampton Garden Club has just completed an authentic, very beautiful seventeeth century herb garden—so you can see that we have historic interests as well as rose shows.

Thank you for listing our rose show in the "Calendar."

EDNA M. POTTER
(*Mrs. John S. Potter*)
Southampton, Long Island

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MRS. WILLIAM PHELPS, JR	*Collaborator in Venezuelan Botany*

I have visited Virginia and North Carolina and certain areas in Pennsylvania several times for the purpose of seeing the native azaleas. I shall now appreciate them all the more and understand why I have noticed variation in flower color on plants of the same species, after reading Mr. Leach's informative article in the May-June 1960 issue of *The Garden Journal.*

E. NOLTE
New York, N. Y.

MEMBERSHIP (from page 195)

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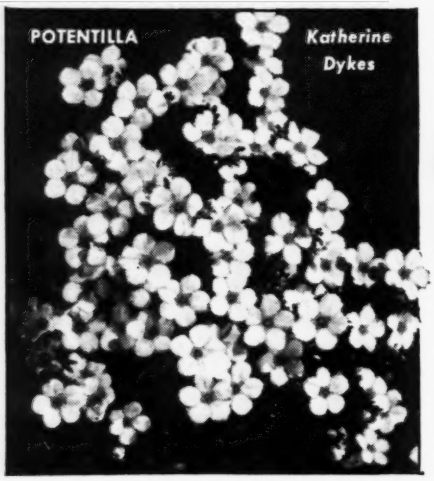

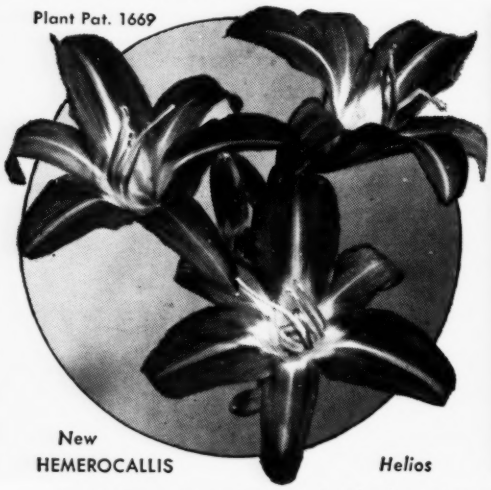

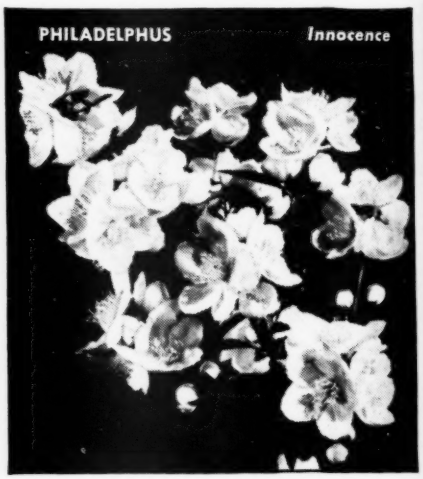

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